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ENGINEERING DATA TRANSMITTAL

Page 1 of 1

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7. Abstract

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1.0 INTRODUCTION

1.1 PURPOSE

This supporting document describes the design, operations, and monitoring of the vapor extraction system (VES) to be used in the 200 West Area, Hanford Site, Washington (Figure 1-1). The VES is designed to extract and collect carbon tetrachloride from unsaturated soils beneath, and in the vicinity of, three carbon tetrachloride disposal sites (Figure 1-2). Remediation of the soils is being conducted as part of the 200 West Area Carbon Tetrachloride Expedited Response Action (ERA), a removal action under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980.

1.2 BACKGROUND

1.2.1 200 West Area ERA

The 200 West Area carbon tetrachloride ERA is being conducted by the U.S. Department of Energy (DOE) at the direction of the U.S. Environmental Protection Agency (EPA) and the Washington Department of Ecology (Ecology) as a provision included in CERCLA. An ERA allows expedited responses to be taken at waste sites where early remediation will abate imminent hazards or prevent significantly increased degradation that might occur if action were delayed until completion of a remedial investigation/feasibility study (RI/FS) and record of decision. The ERA is being initiated based on concerns that the carbon tetrachloride residing in the soils underlying the 200 West Area is continuing to serve as a source of contamination to the ground water. Thus, the purpose of the ERA is to minimize contaminant migration within the unsaturated soils in the 200 West Area by removing the carbon tetrachloride.

Based on results of a VES pilot test conducted in the spring of 1991 and an engineering evaluation/cost analysis (EE/CA), the EPA issued an action memorandum directing the initiation of the first phase of soil vapor extraction in the 200 West Area. The proposed action for removing the carbon tetrachloride in the unsaturated soils is to use soil vapor vacuum extraction with aboveground collection of the carbon tetrachloride on granular-activated carbon (GAC), using a network of soil vapor extraction vadose wells. The GAC will be sent offsite to be regenerated and carbon tetrachloride destroyed.

1.2.2 Volatile Organic Compounds - Arid Integrated Demonstration

Another supporting activity that affects the design and operation of the VES is components of the Volatile Organic Compounds - Arid Integrated Demonstration (VOC-Arid ID). The VOC-Arid ID is one of several DOE integrated demonstrations designed to support the testing of emerging environmental management and restoration technologies. The principal objective of the VOC-Arid ID at the Hanford Site is to determine the viability of emerging technologies that can be used to remediate arid or semiarid sites containing VOC (e.g., carbon tetrachloride) with or without associated metal and radionuclide contamination. During the first few years, the VOC-Arid ID activities will focus primarily on the carbon tetrachloride contamination and associated contaminants found in the 200 West Area.

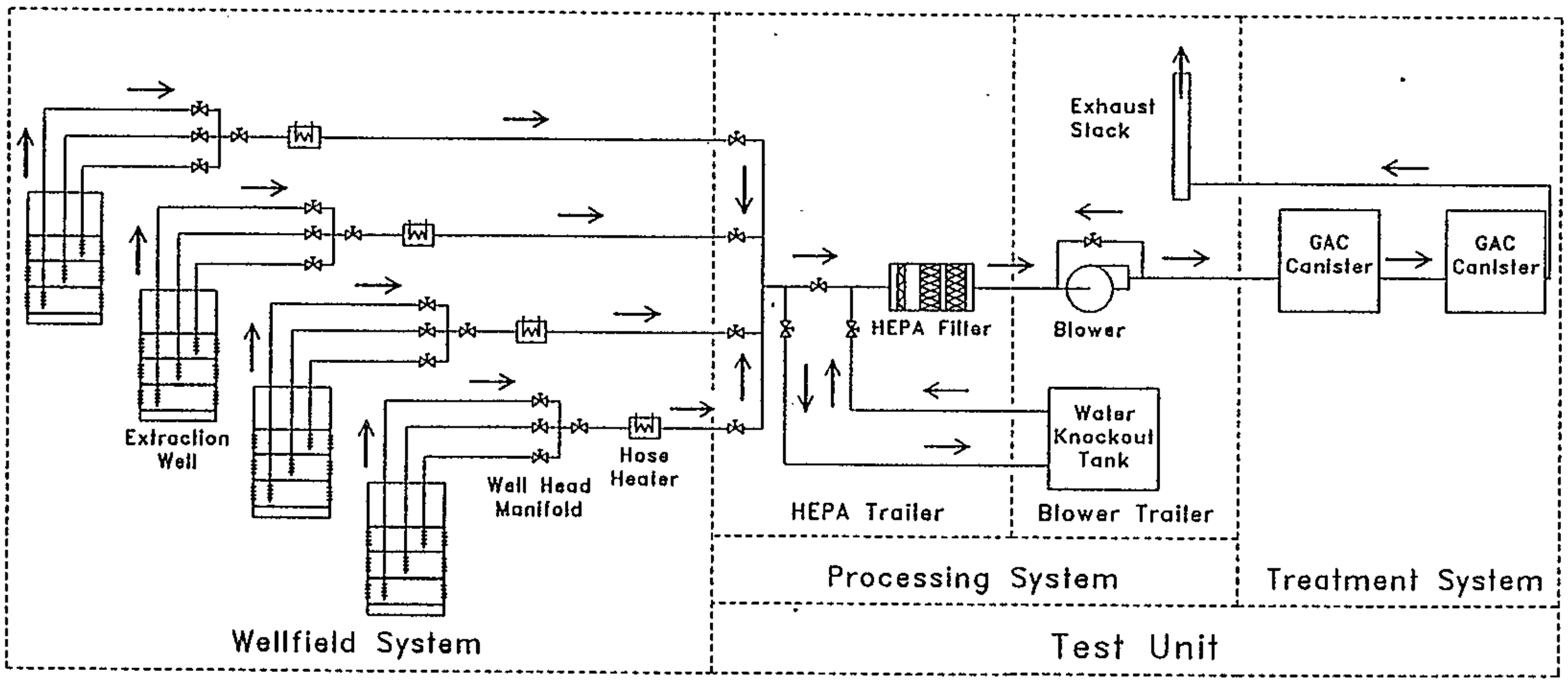
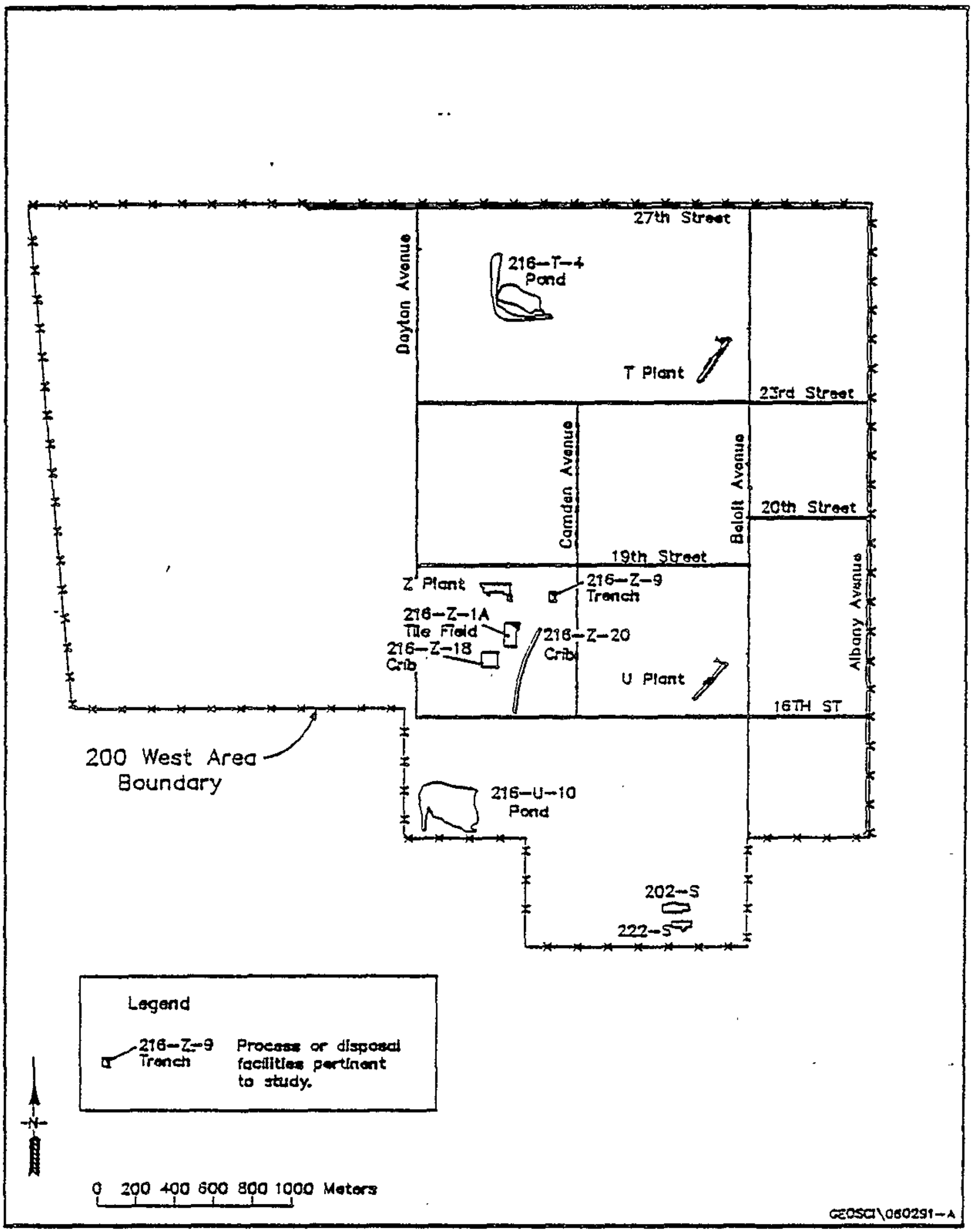


Figure 1-1. Vapor Extraction System.

Figure 1-2. Site Map of 200 West Area.



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1.3 REGULATORY COMPLIANCE

The operations will be conducted per various State and Federal regulations, the National Environmental Policy Act (NEPA), and various DOE orders. In the EE/CA (DOE-RL 1991), several regulatory requirements were identified to which the design and operation of the VES must adhere (Appendix A).

Before implementation, an environmental assessment (EA) was written to comply with NEPA. The EA was included in the Expedited Response Action Proposal for the 200 West Area Carbon Tetrachloride Plume (DOE-RL 1991). A finding of no significant impact was issued by DOE Headquarters for the first phase of remediation.

1.4 SUMMARY OF SOIL PHYSICAL AND CONTAMINANT CHARACTERISTICS

The upper geologic unit of the 200 West Area consists of two facies: (1) coarse-grained sand and granule to boulder gravel from which matrix is commonly lacking, and (2) fine- to coarse-grained sand and silt that commonly display normally graded rhythmites a few centimeters to several decimeters thick. In general, this unit is composed of approximately 50% sands and gravels, 45% cobbles, and 5% boulders and, in the 200 West Area, ranges in thickness from 6 to >60 m. It is underlain by 1.5 to 18 m of silts and fine sands, which in turn are underlain by another gravel unit.

Carbon tetrachloride vapor concentrations observed throughout the 200 West Area in 1991 range from less than detectable to several thousand parts per million by volume in the unsaturated zone. Observed concentrations are highest in the vicinity, and west of, the three sites (216-Z-9 Trench, 216-Z-1A Tile Field, and 216-Z-18 Crib) where the carbon tetrachloride was discharged to the soil column (Figure 1-2).

Carbon tetrachloride breakdown products, chloroform and methylene chloride, also have been observed in soil samples in trace amounts. Other substances that have been identified in trace amounts in at least one soil sample from the 200 West Area include: a benzene; fluoromethane; 1,1-dichloroethylene; trans-1,2-dichloroethylene; trichlorofluormethane; methyl isobutyl ketone; and toluene (DOE-RL 1991).

Many of the liquid waste streams discharged to the soil column in the 200 West Area since 1944 have contained radionuclides. For example, the primary radionuclide components of the aqueous and organic liquids discharged to the three carbon tetrachloride disposal sites were plutonium and americium. The plutonium contamination extends approximately 30 m beneath the 216-Z-1A Tile Field; the lateral spread is limited within a 9-m-wide zone around the perimeter of the tile field. Other radionuclides, such as radioactive isotopes of cesium, cobalt, hydrogen, iodine, strontium, and technitium, have been discharged to the soil column beneath the 200 West Area. In addition, radon gas occurs naturally in Hanford soils.

1.5 SCOPE

The VES will initially be operated around the 216-Z-1A Tile Field. Subsequently, the system will be used at other disposal sites in the area (i.e., 216-Z-9 Trench and the 216-Z-18 Crib). This version of the plan will concentrate on its use in the 216-Z-1A Tile Field, along with the well field encompassing the tile field.

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2.0 VAPOR EXTRACTION SYSTEM DESIGN

The VES to be used with the 216-Z-1A Tile Field will be an engineered upgrade of the system used during the pilot test. Both the pilot test design and the upgraded version are described in this section.

2.1 BACKGROUND

2.1.1 General Vapor Extraction Process

Soil vapor extraction is a physical means of removing VOC from contaminated soil. The typical system consists of a network of vacuum extraction wells screened in the contaminated zone. The extraction wells are joined together by a common header pipe, which is connected to a vapor separator where water is removed. The separator is then connected to a positive displacement blower, which provides a negative pressure gradient in the subsurface. Discharge from the blower is vented to the atmosphere or connected to an offgas treatment system, depending on air emissions requirements and the nature and extent of VOC contamination.

The subsurface vacuum created by the blower pulls VOC-laden vapors through the subsurface into the extraction wells. Pulling air through soil voids disrupts the equilibrium concentration between liquid or sorbed contaminants and VOC present in the gaseous states.

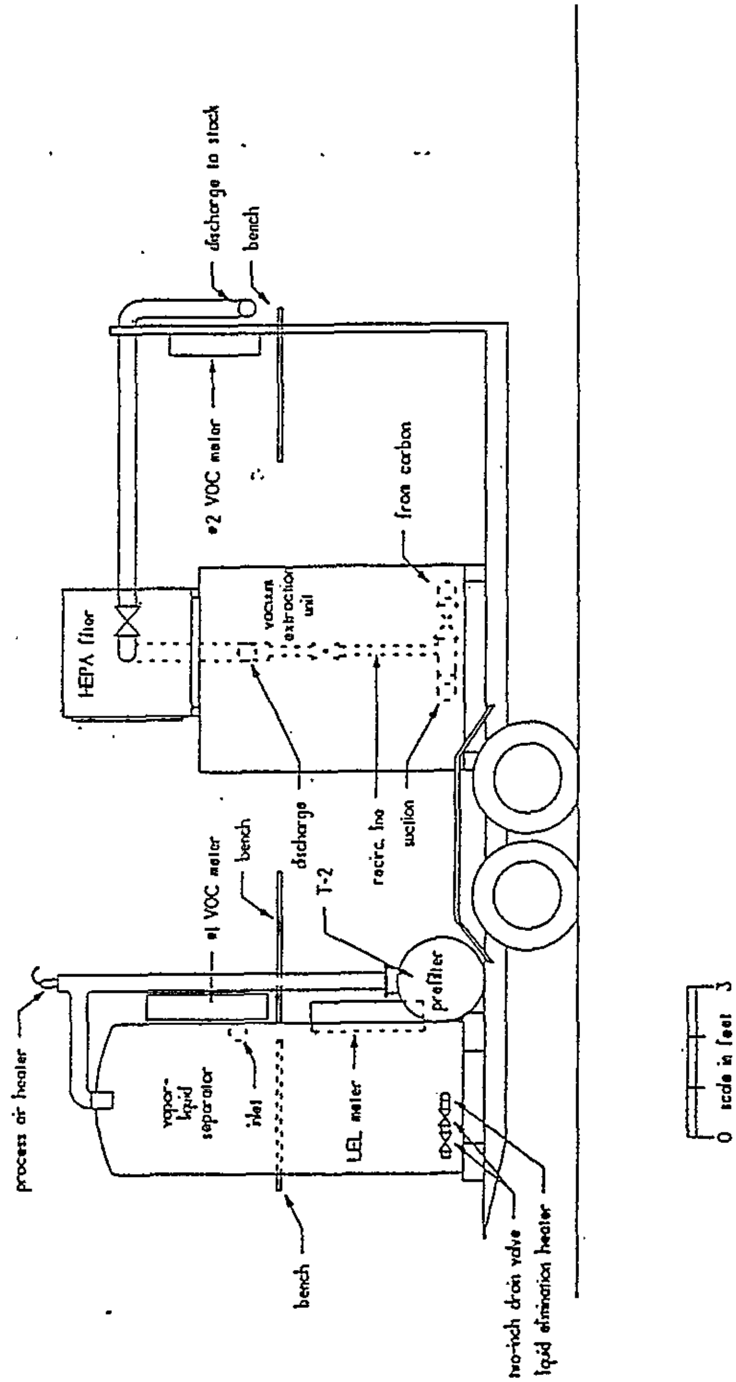
2.1.2 VES Design Pilot Test Design

In the spring of 1991, a soil vapor extraction test was conducted using a VES system (see Figures 2-1, 2-2, and 2-3) at the 216-Z-1A Tile Field. The unit was trailer-mounted. The major components of the system included the intake manifold, water knockout tank, prefilter, GAC canisters, blower, high-efficiency particulate air (HEPA) filters, exhaust stack, piping and instrumentation. Table 2-1 contains a listing of the components of the characterization unit. The well field design included four wells used for extraction and observation. These four wells were W18-87, W18-150, W18-167, and W18-171 and each had perforated intervals at various depths.

The VES design went beyond the typical VES to address the potential for radionuclide particulates potentially brought up the extraction wells to contaminate the components of the VES. As a safety precaution, HEPA filters were added to the system. In addition, alpha and beta continuous air monitors (CAM) were added to the system. The process area of the VES was cordoned off as a radiologically controlled zone.

Test results indicate that no man-made radionuclides were pulled from the wells and into the system (DOE 1991). However, naturally occurring radon and associated daughter products were found in the system. More information on the test results is provided by DOE-RL (1991).

Figure 2-1. Characterization Test Unit Vacuum Extraction Trailer - Side View.



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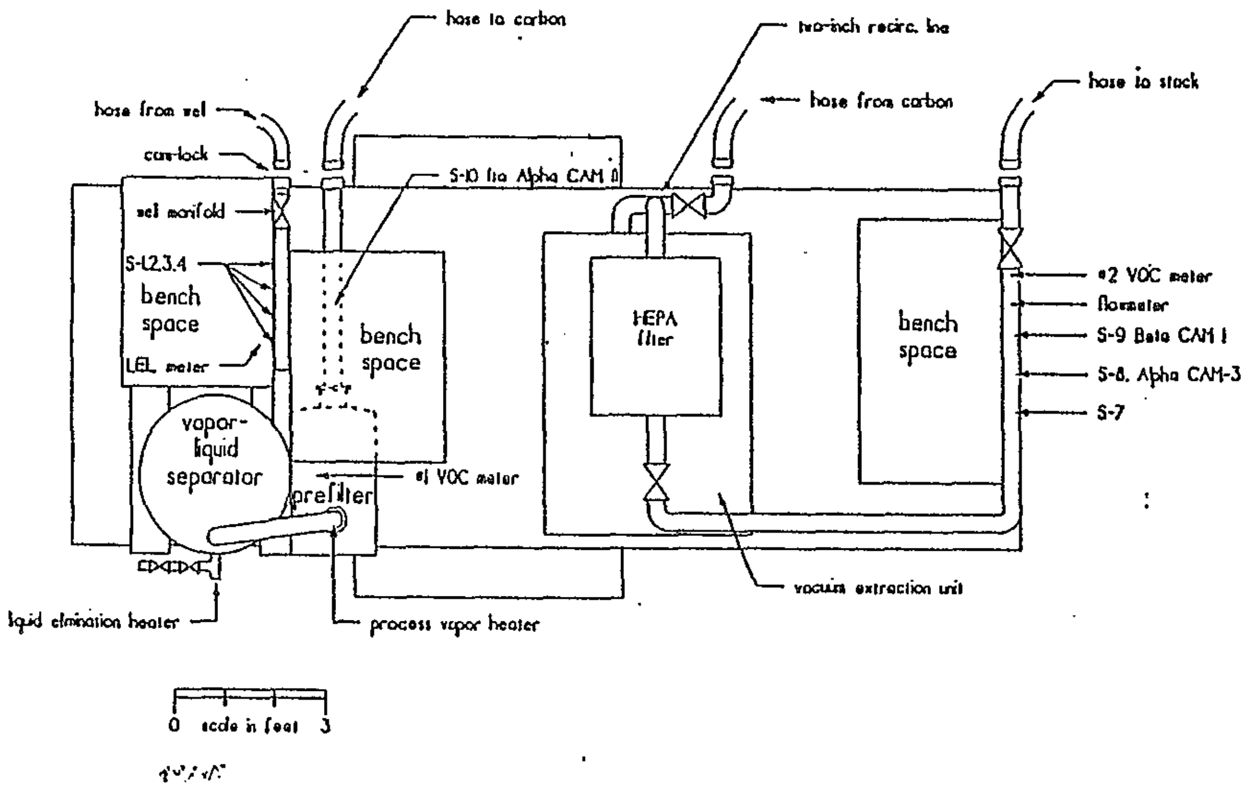

Figure 2-2. Characterization Test Unit Vacuum Extraction Trailer - Top View.

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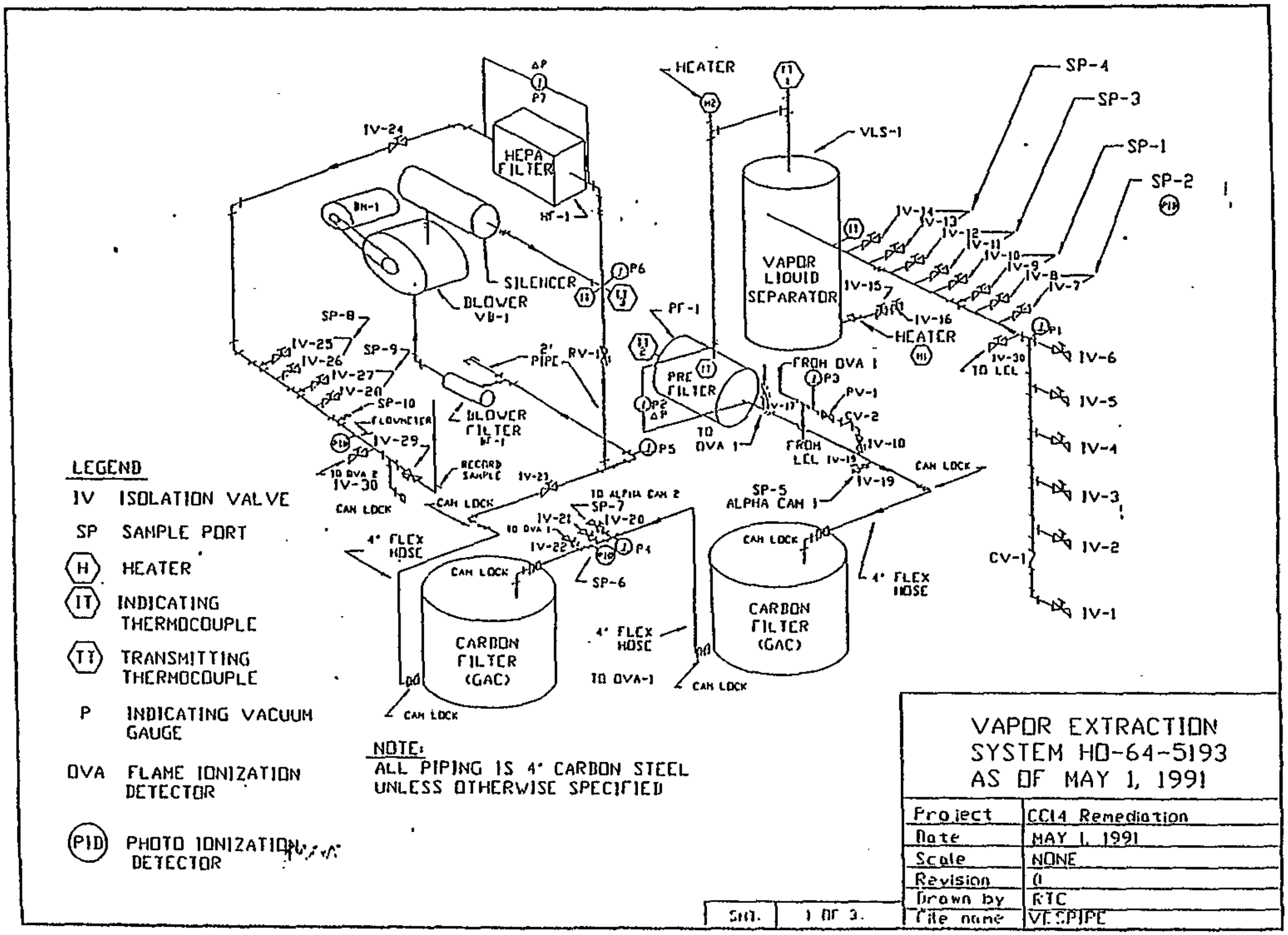


Figure 2-3. Characterization Test Unit Piping Layout.

Table 2-1.

NAME	EQUIP. NO.	QTY	DESCRIPTION
Vapor Liquid Separator	VLS-1	1	Water knockout tank with demister
Electric Immersion Heater	H1	1	1.25 in. NPT Screw-Plug Immersion Heater 120 V, 1-Phase, Mod. No. BEN24G6.
Electric Immersion Heater	H2	1	2.5 in. NPT Screw-Plug Immersion Heater 480 V, 3-Phase, Mod. No. BLNA63R5
Pre-Filter	PF-1	1	9.0 in. I.D. x 14.625 in. O.D. x 14.5 in. ht. Mod. No. 376P, Solberg Manufacturing, Inc.
Carbon Filter	GAC	2	Carbon Canisters Containing 1000 lb of Grade CC-601 Carbon, Westates Carbon Co.
Blower Filter	BF-1	1	4.75 in. I.D. x 7.875 in. O.D. x 9.625 in. ht. Mod. No. 243P, Solberg Manufacturing, Inc.
Vacuum Blower	VB-1	1	Rotary Type Blower, Mod. No. 4506, Unit No. PR-15, Serial #-2429, Part#-156662, Duroflow Corp.
Silencer	N/A	1	Maxim Silencer, Mod.#-4M41, Serial #-224160-01-14, Riley-Beaird, Inc., Shrevport, IA.
Blower Motor	BM-1	1	15hP Electric Motor, 480 V, 3-Phase 3460 rpm, Voltage-208-230/460, Amperage-406-18/36 Cat.#-150064, Mod.#-N215T34081, Leeson Electric Corp., Grafton, Wis.
HEPA Filter Housing	HF-1	1	E-Series Bag Out Housing, 30.0 in. ht. x 27.25 in. w. x 36.5 in. deep. Mod. No. E-8, Flanders Filters Inc.
HEPA Filter		1	24 in. x 24. in. Filter Mod. No.HPS159
Sample Port Connections	SP-1 thru SP-10	10	0.25 in. Tubing x 0.25 NPT Swagelock Fittings.
Isolation Valves	IV-1 thru IV-6, IV-23, IV-24, IV-29	9	4.0 in. NPT x 4.0 in. NPT, Brass Ball Valves
Isolation Valves	IV-7, IV-8	2	0.375 in. NPT x 0.375 in. Tubing, Needle Valves
Isolation Valves	IV-9 thru IV-14, IV-19 thru IV-21, IV-25 thru IV-28	13	0.25 in. Tubing x 0.25 in. Tubing, Stainless Steel Ball Valves
Recirculation Valve	RV-1	1	2.0 in. NPT x 2.0 in. NPT Brass Ball Valve
Isolation Valves	IV-17 thru IV-19, IV-22, IV-30	5	0.25 in. NPT x 0.25 in. NPT Brass Ball Valve
Isolation Valves	IV-25, IV-16	2	2.0 in. NPT x 2.0 in. NPT Brass Ball Valves
Proportional Flow Control Valve	PV-1	1	Electric High Capacity Flow Control Valve, Mod. No. 10-201-90N, Manufac. Herion Co., Warrendale, PA

The VES functioned well during the test; however, several improvements were identified that will be incorporated in the design upgrade. Some of the improvements are listed as follows:

- HEPA filters should be located further upstream, ahead of most of the equipment and instruments, to reduce the amount of equipment and instruments potentially exposed to particulate radioactive contamination.
- Instrumentation should be better matched to the system (i.e., instrument detectors).
- Sampling ports need to be more accessible.
- Better lighting is required for nighttime activities.
- System should be more automated.
- Data acquisition system (DAS) should have greater information capacity and flexibility.

2.2 GENERAL DESIGN REQUIREMENTS

The general design requirements for the VES system are as follows:

- Extract and collect carbon tetrachloride and associated organic vapors.
- Modify characterization unit.
- Use existing wells (in and around the 216-Z-1A Tile Field).
- Operate in ambient conditions ranging from -10°F to 110°F.
- Use GAC to collect the carbon tetrachloride and send the GAC offsite for regeneration.
- Make processing and treatment equipment mobile.
- Prevent contamination of the VES by man-made radionuclides.
- Meet regulatory and safety requirements.
- Control flow rate between 0 to 500 ft^3/min and vacuum pressure up to 10 inches of mercury (135.8 inches of water) vacuum.

The general design requirements also include limits established by the safety assessment and by regulatory issues which are applicable or relevant and appropriate requirements (ARAR).

The safety assessment dictated three operational safety limits (OSL) for the operation of the VES. These design requirement limitations are as follows:

- Placement of a carbon tetrachloride detector downstream of the final GAC canister that is set to alarm (also interlocked with the logic system to shut down the blower) if concentrations of carbon tetrachloride exceed 25 ppm.

- Flow rate meters located upstream of the blower and downstream of the final GAC canister will be in place and interlocked with the logic system to shut down the blower in the event there is a flow rate variance >10%.

- A minimum of two GAC canisters in place (two in series) to adsorb any carbon tetrachloride in the event breakthrough of the first GAC canister occurs.

The general design requirements directed by ARAR include the following:

- Be capable of keeping carbon tetrachloride levels at the fenceline below the acceptable source impact level (ASIL) of 0.067 mg/m^3.

- Be capable of keeping the carbon tetrachloride emissions below the reportable quantity (RQ) of 10 lb/d.

2.2.1 Processing Equipment Design Requirements

The processing equipment design requirements are as listed below.

- Intake Manifold:
  - <u>Function</u> - Provide inlet for hoses from extraction wells.
  - <u>Performance</u> - Must provide for four extraction wells and be capable of routing flow up to 500 ft^3/min from any one well.
  - <u>Constraints</u> - Must fit on existing trailer within space available of 80 by 110 inches. Must be capable of operating in a vacuum up to 150 inches of water.

- Heater:
  - <u>Function</u> - Heat soil gas.
  - <u>Performance</u> - Heat soil gas up to 225°F downstream of the heater element (1 inch) for flow rates between 50 and 500 ft^3/min in ambient conditions ranging from -10°F to 110°F.
  - <u>Constraints</u> - Must not create phosgene in appreciable quantities.

- Filtration:
  - <u>Function</u> - Prevent general particulate and actinide particulate from further movement downstream.
  - <u>Performance</u> - Shall be 99.97% efficient for particles >0.3 µ.
  - <u>Constraints</u> - Must be capable of fitting in an available space of 140 by 30 inches. Must be capable of operating in a vacuum up to 150 inches of water.

- Vacuum Blower:
  - Function - Supply negative pressure in well field to induce volatilization and extract carbon tetrachloride and associated VOC and push those components through a treatment system.
  - Performance - Rotary, positive displacement vacuum blower, V-belt drive, electric motor driver, discharge silencer, capable of operating up to 750 ft^3/min at 150 inches of water vacuum and 5 lb/in^2 pressure.
  - Constraints - Noise 30 ft from blower must not exceed 100 db. In operation with bypass loop, exit temperature must not exceed 225°F.

- Exhaust Stack:
  - Function - Release soil gas to atmosphere.
  - Performance - Stack height of 20 ft above ground surface and diameter of 6 inches. Allow compliance sampling and flow rate measurement.
  - Constraints - Must be placed as the final component in the system. Must be capable of being secured so as to not topple during high wind conditions. Must be capable of operating in pressure up to 5 lb/in^2.

- Sampling:
  - Function - Provide access to sample air stream for organics and radon and provide access to water knockout tank to sample liquid.
  - Performance - Easy access with cabinet, valving, and sampling pump. Sampling cabinet must provide a working space and weather protection for sampling activities. All intake manifold lines, HEPA filter effluent line, hose between GAC canisters, and exhaust line must have sample ports.
  - Constraints - Samples may need to be filtered to preclude radiation contamination. Sampling system components must not interfere with sample quality.

- Water Knockout Tank:
  - Function - Reduce moisture content of the soil gas stream.
  - Performance - Remove moisture from soil gas passing through at 50 to 500 ft^3/min. Reduce relative humidity of soil gas to below 70%.
  - Constraints - Must operate at 50 to 500 ft^3/min in vacuum up to 150 inches of water. Must be capable of containing at least 50 gal of liquid. Must be equipped with a heater to prevent freezing of the liquid. Must be fitted with air heater. Must allow sampling of liquid and allow liquid removal by gravity drain.

- Piping, Fittings, Valves, and Hoses:
  - Function - Provide flow path for soil gas.
  - Performance - Allow flow from 50 to 500 ft^3/min in vacuum up to 150 inches of water and pressure up to 5 lb/in^2. Piping, fittings, and valves must be made with national pipe thread ends. Valves must be rated at least 150 WSP and 600 WOG. Hose must be wire-reinforced and fitted with quick-connect fittings.
  - Constraints - Must be capable of extended use in outdoor conditions. Materials of construction must be compatible with carbon tetrachloride concentrations up to 10,000 ppm. Aluminum may not be used.

- Electrical:
  - Function - Provide electricity to the various electrical components.
  - Performance - All wiring and equipment shall meet or exceed the National Electric Code and shall be NEMA 3R (TRADENAME??) weatherproof or better.
  - Constraints - All wiring must be contained in conduit and must be capable of supplying full power requirements with at least a 10% spare capacity.

2.2.2 Collection/Treatment System

The collection/treatment system is to remove the organics from the soil gas stream. Use GAC in canisters holding 500 to 2,500 lb of carbon. The capacity of carbon tetrachloride on the carbon shall be at least 60% by weight. The carbon shall be regenerated offsite.

The canisters shall be U.S. Department of Transportation approved for shipping. The carbon shall be delivered with <15 pCi/L activity. The treatment system shall be capable of functioning up to 5 lb/in^2 at 50 to 500 ft^3/min flow rate. The treatment system shall not release a concentration of carbon tetrachloride greater than 25 ppm.

2.2.3 Well Field

Wells provide access to the soil vapor in the subsurface to maximize extraction of carbon tetrachloride and associated organics. The major constraint is the use of existing wells.

Well configurations provide ability to extract or monitor depending on configuration. Perforations in casing must provide at least 3% open area in perforated intervals. Access to individual perforated intervals must be provided by packers or by piping. Changes to well must not preclude future ability for closure to Washington Administrative Code standards and must not allow extraction of radionuclide particulates.

2.2.4 Process Control System

The process control system provides monitoring and process control of system through instrumentation and computer logic. The process control system is capable of: (1) performing logic functions and branching functions, (2) sending signal to shut down the blower in the event of a parameter exceedance, and (3) monitoring and storing data from the VES operations. The process control system must monitor carbon tetrachloride and radon concentrations, pressures, flow rates, temperatures, and relative humidity.

The process control system must be capable of operating in -10°F to 110°F temperatures. Must have at least 48 input/output channels with the capability of infinitely increasing the number channels. Ability to reprogram functions performed by channels. Adaptable to various instrument signals.

2.3 SYSTEM DESIGN

2.3.1 Well Field Description

The well field for the 216-Z-1A Tile Field will function to extract carbon tetrachloride and associated VOC and to monitor well field conditions, (i.e., vacuum, permeability to airflow, carbon tetrachloride plume migration, etc.). Extraction and monitoring wells are modified from existing wells in and around the tile field. All of the existing wells have carbon steel casing. Initially one extraction well and six monitoring wells will be used in the system (Figure 2-4). Later in the soil vapor extraction process, the well field will be modified to include five extraction wells and six monitoring wells (Figure 2-5). The extraction wells are connected to the processing system and the process control system while the monitoring wells will be connected only to the process control system. Extraction and monitoring wells may be interchanged. The locations of the extraction and monitoring wells were chosen based on available wells and geographic position. The perforated intervals of the wells were chosen

2.3.1.1 216-Z-1A Tile Field Well Configuration. The Phase I configuration extraction well (W18-150) consists of existing carbon steel casing with perforations at three intervals. A perforated interval is isolated using a packer system (see Figure 2-6). The packer assembly consists of two inflatable packers. The packer assembly can be moved with a hoist truck. The well field configuration is shown in Table 2-2.

Monitoring wells measure vacuum in the well field. The carbon steel casing in each well is perforated at one or more intervals. Four of the monitoring wells have a single perforated interval and are sealed with a cap at the top of the casing (Figure 2-7). Two of the monitoring wells are perforated at three intervals and use packer systems to isolate the various intervals for monitoring of vacuum.

Figure 2-4. Available Existing Wells Around the Three Disposal Sites - Initial Configuration.

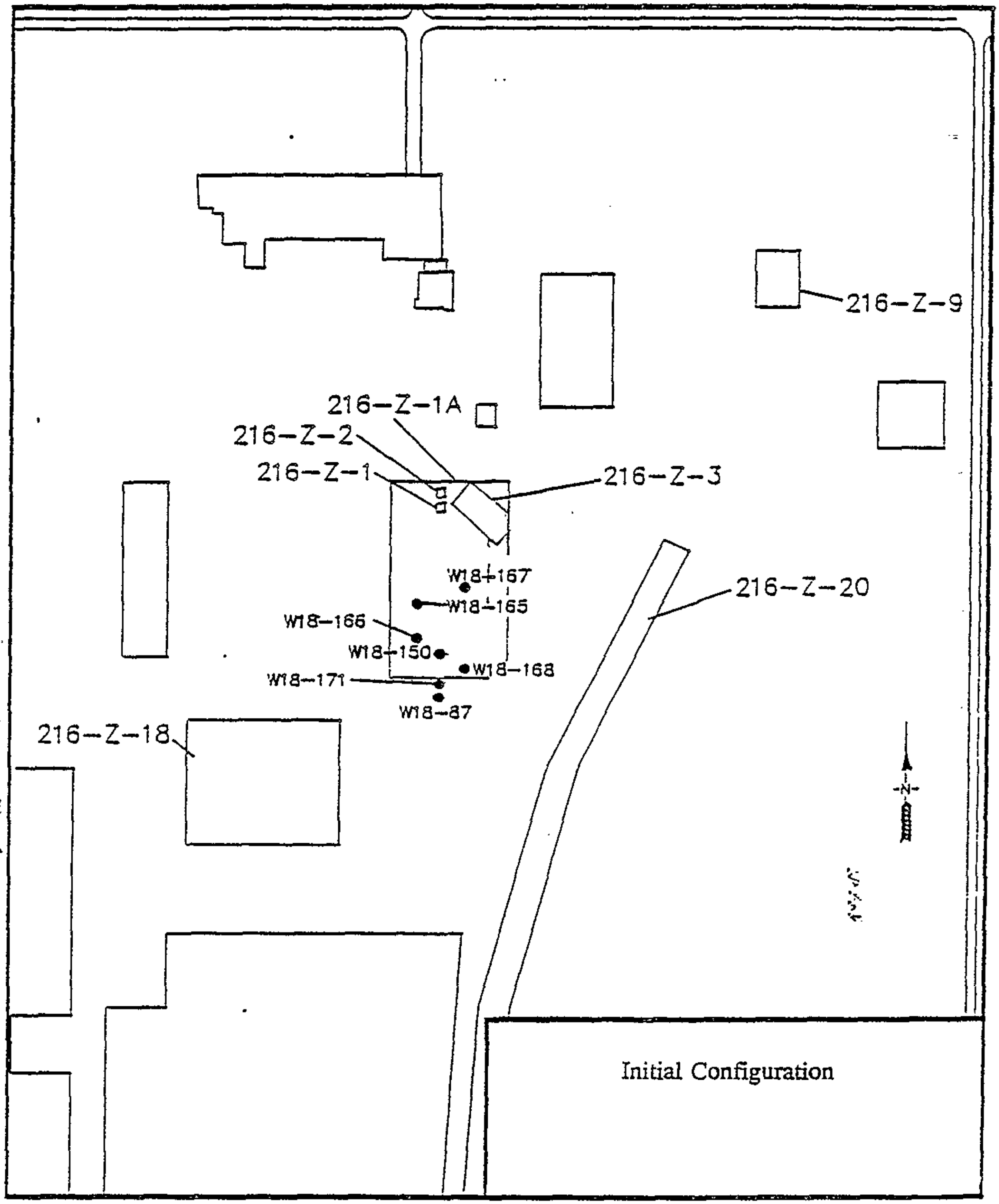
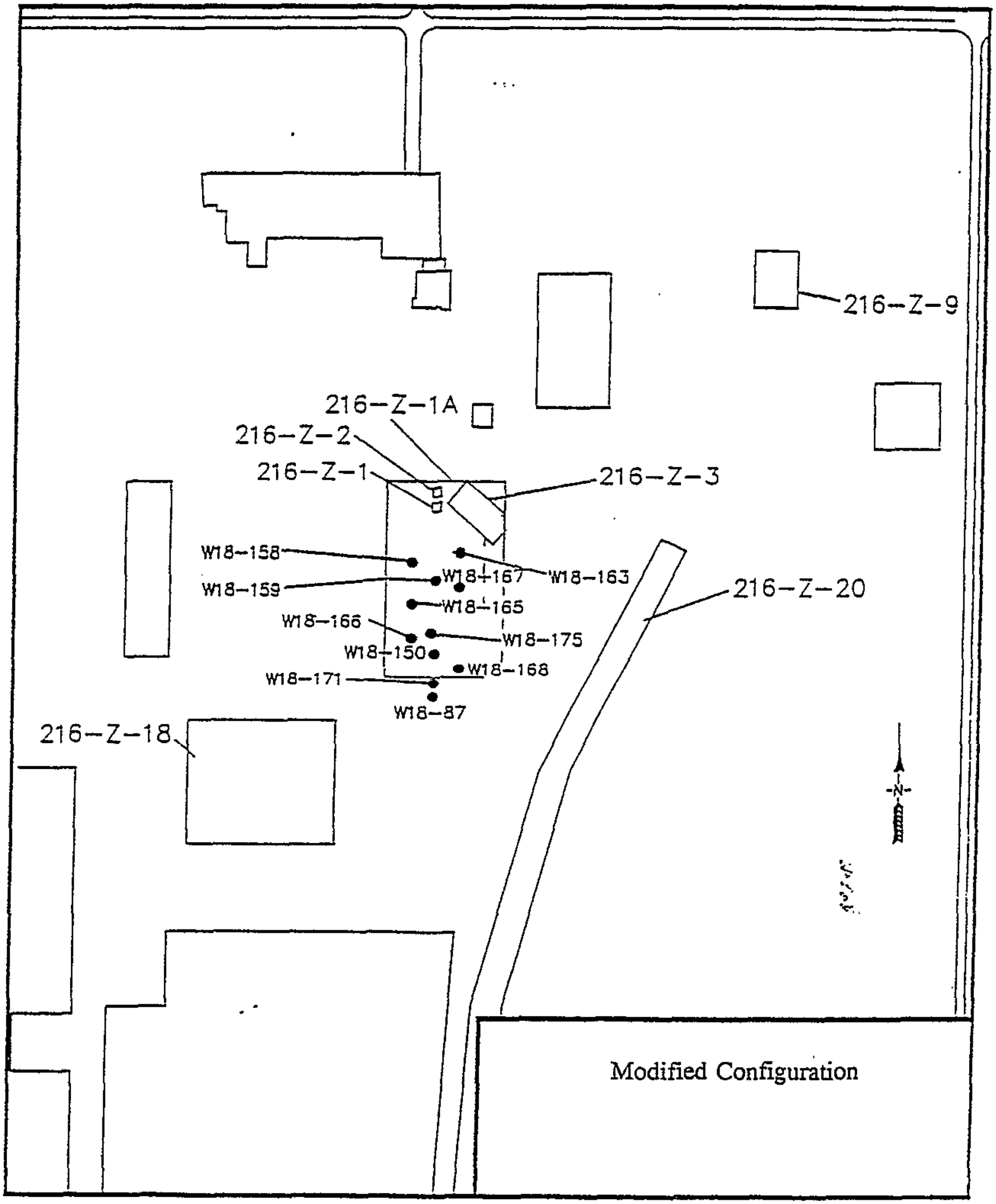


Figure 2-5. Available Existing Wells Around the Three Disposal Sites - Modified Configuration.



9 2 1 2 1 9 3 1 5 5 1

Figure 2-6. Typical Extraction Well Construction.

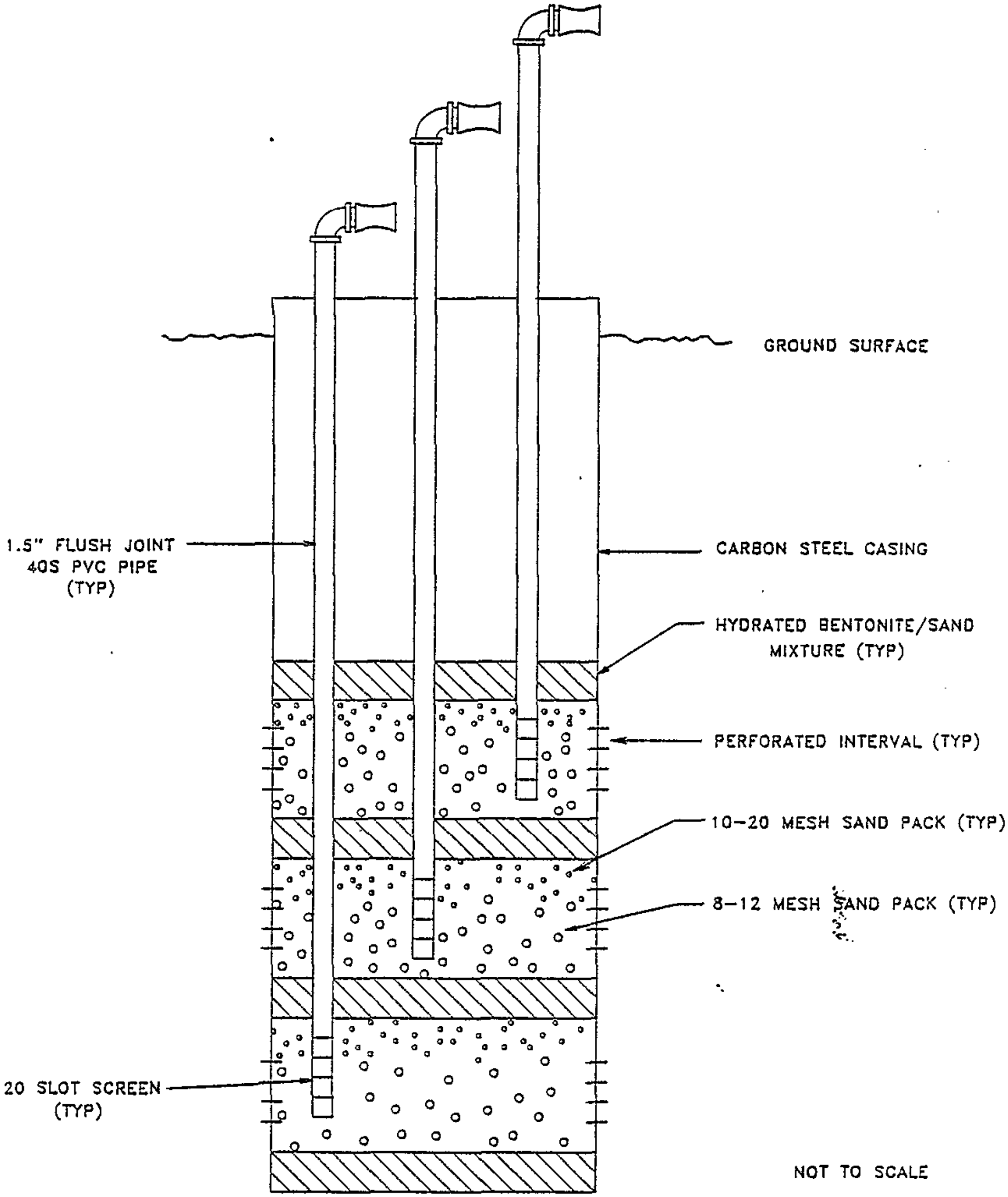


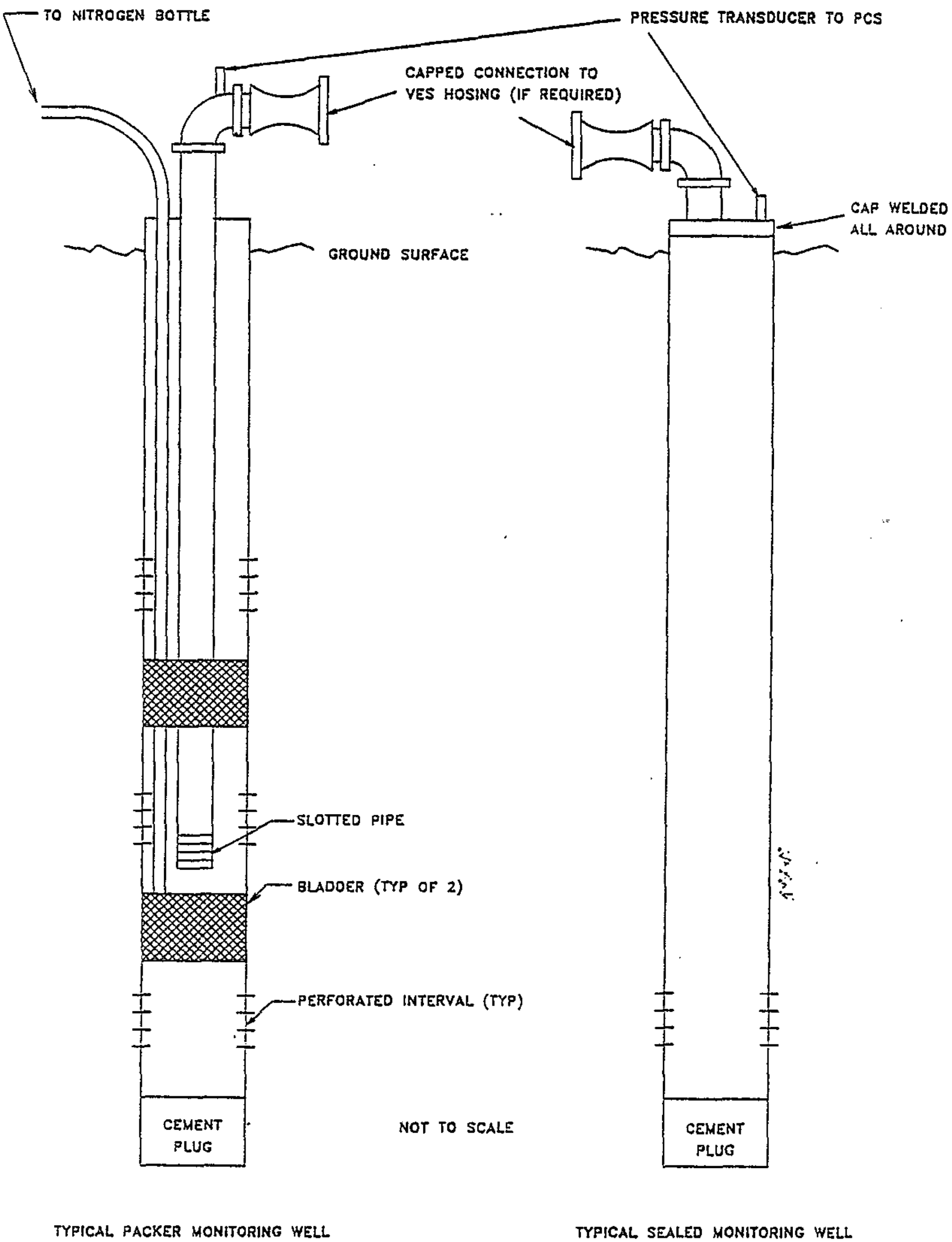
Table 2-2. Phase I Well Field Configuration at the 261-Z-1A Tile Field.

Well	Type	Casing Diameter (in.)	No. of Pipes	Perforated Interval (ft below top of casing)	Open Area in Perforated Interval (%)
W18-150	Extraction	6	3	62 to 67 82 to 87 111 to 116	4 4 4
W18-87	Monitoring	6	1	33 to 38 65 to 70 125 to 130	4 4 4
W18-165	Monitoring	6	0	122 to 127	4
W18-166	Monitoring	6	0	124 to 129	4
W18-167	Monitoring	8	0	114 to 119	3
W18-168	Monitoring	8	0	118 to 123	3
W18-171	Monitoring	8	1	20 to 25 57 to 77 115 to 130	3 3 3

Phase II will consist of configuring four more extraction wells and reconfiguring the extraction well used in Phase I. Each extraction well will contain three piezometer tubes, which will extract/monitor three stratigraphic intervals in the unsaturated soils above the caliche horizon. Bentonite isolation seals will be placed above each sand pack to isolate each extraction/monitoring horizon from the next overlying extraction/monitored horizon. The piezometer string will consist of (1) polyvinyl chlorinated (PVC) pipe, (2) one or more screened sections, (3) a multiple gradation filter pack (coarse sand and fine), and (4) bentonite seals. Phase II well field configuration is shown in Table 2-3. There is no planned change to the design of the monitoring wells for the Phase II configuration.

No disturbances of the soils in the 216-Z-1A Tile Field may be performed. Operations that may impact the soils must first be cleared through criticality analysis. During Phase I and Phase II, no new wells will be drilled.

Figure 2-7. Typical Monitoring Well Constraction.



9 2 1 2 1 9 3 0 5 5 4

Table 2-3. Phase II Well Field Configuration at the 216-Z-1A Tile Field.

Well	Type	Casing Diameter (in.)	No. of Pipes	Perforated Interval (ft below top of casing)	Open Area in Perforated Interval (%)
W18-150	Extraction	6	3	62 to 67 82 to 87 111 to 116	3 3 3
W18-158	Extraction	6	3	75 to 80 89 to 94 119 to 124	3 3 3
W18-159	Extraction	6	2	70 to 80 112 to 119	3 3
W18-163	Extraction	8	3	67 to 77 90 to 97 112 to 117	3 3 3
W18-175	Extraction	6	3	68 to 75 87 to 94 115 to 120	4 4 4
W18-87	Monitoring	6	1	33 to 38 65 to 70 125 to 130	3 3 3
W18-165	Monitoring	6	0	122 to 127	4
W18-166	Monitoring	6	0	124 to 129	4
W18-167	Monitoring	8	0	114 to 119	3
W18-168	Monitoring	8	0	118 to 123	3
W18-171	Monitoring	8	1	20 to 25 57 to 77 115to 130	3 3 3

2.3.1.2 Well Construction. The basic well construction for the five extraction wells is shown in Figure 2-6. Materials placed in the well allow access to any or all of the perforated intervals. The materials include PVC pipe, sand, and bentonite. The coarse sand in the perforated interval is highly permeable to air flow and allows flow from the perforations to the slotted screen of the piezometer tube (PVC pipe). Bentonite is a type of clay placed above and below each perforated interval to prevent air from flowing through the well casing, effectively isolating each of the perforated intervals. The fine sand lying between the layers of bentonite and coarse sand provides a barrier to prevent the intermixing of the two materials which would impede the functions of both.

The typical monitoring well construction is shown in Figure 2-7. The four monitoring wells that have a single perforated interval have caps secured to form a vacuum-tight seal and the casing is used as the conduit to the perforated interval. In the other two monitoring wells, packer systems are installed which allow monitoring one of the three perforated intervals available in each.

2.3.1.3 Well Perforations. The wells are perforated at selected intervals to provide a means of monitoring and extracting soil vapor from a specific soil horizon in the subsurface. The intervals are determined by analysis of the characterization test data and known geological data. Pipes extending down the casings are screened in the same zone as the perforated interval. Figure 2-6 shows a perforated well section.

The area of each individual perforation is about 2.8 in^2. There are typically 20 of these perforations per linear foot of casing. This provides an effective open area over the perforated interval of about 4% in the perforated interval of the 6-inch casing and 3% in an 8-inch casing.

2.3.1.4 Well Connections. Each extraction well has a cap. The caps have holders that secure the pipes that extend down the casing to the perforated intervals. An elastomer overlays the tops of these wells to prevent precipitation from entering the well. The caps connect every pipe screened in a perforated interval to a wellhead manifold via a flexible hose. The 6- and 8-inch extraction well caps are shown in Figures 2-8 and 2-9, respectively.

During Phase I operations, a packer system is used in the extraction well and no cap is used.

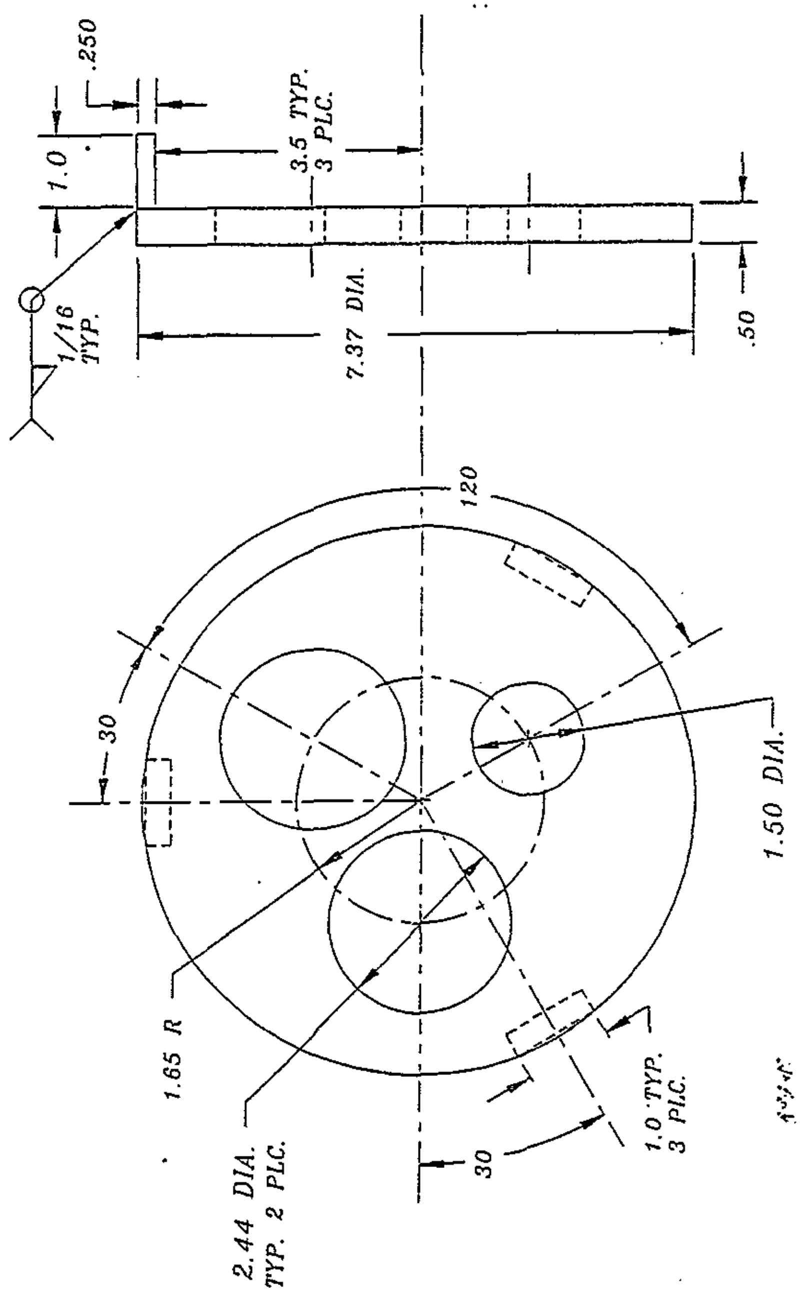
2.3.1.5 Wellhead Manifold. The wellhead manifold has valves which allow flow control from each perforated interval. Wellhead instrumentation provides information on the vacuum pressure of each interval. Each wellhead manifold is connected by a flexible transfer hose to the HEPA trailer manifold.

During Phase I operations, the wellhead manifolds are not to be used. A pressure transducer and pressure gage on the wellhead provide measurements of the extraction vacuum pressures.

2.3.1.6 Well Field Hose and Hose Heaters. Transfer hoses running from the wellhead manifolds to the HEPA trailer manifolds may have one or more heaters installed to prevent vapor condensation in the lines during cold weather operation. The hoses lay on the ground and have positive seal quick release fittings every 20 ft to provide ease of disconnection and movement when necessary. The hoses are staked or otherwise marked and are readily visible to personnel operating vehicles in the area.

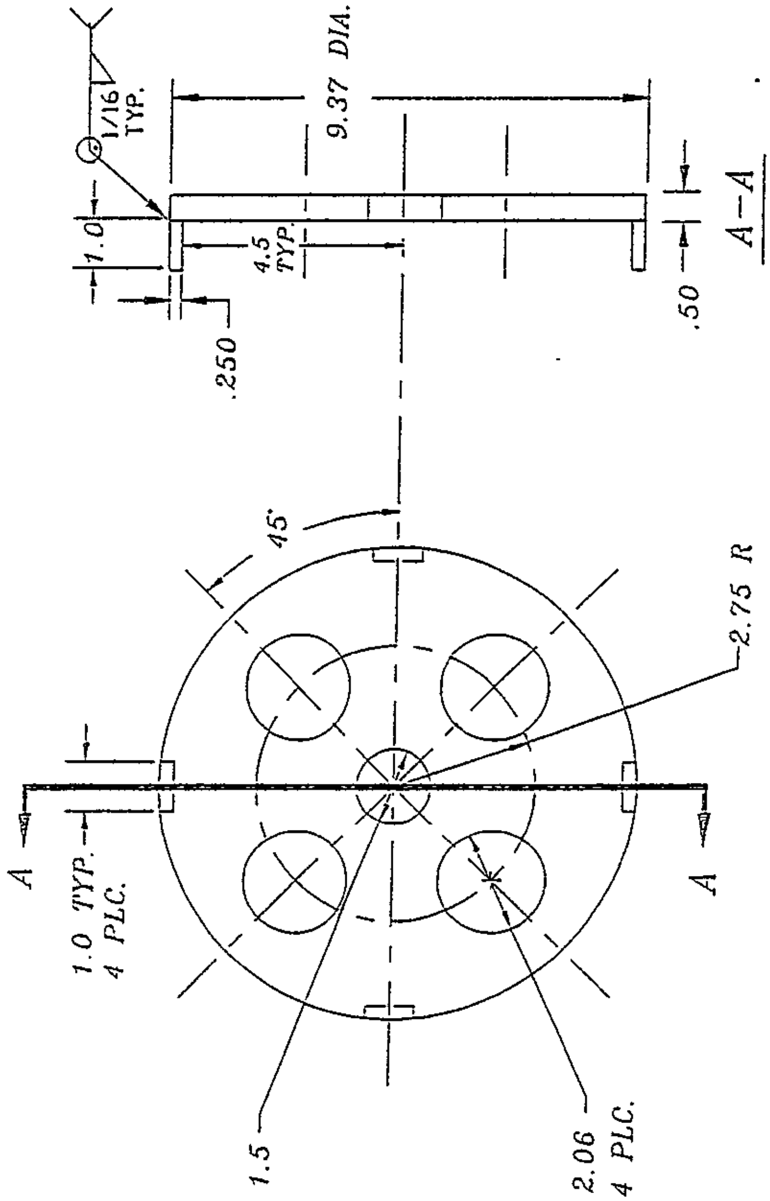
During the Phase I operations, the hose connecting the extraction well to the intake manifold is a continuous piece with quick-release fittings only on the ends. Hose heaters are not used.

Figure 2-8. 6-Inch Extraction Well Cap.



9 2 1 2 1 9 7 0 5 5 7

Figure 2-9. 8-Inch Extraction Well Cap.



2.3.2 Processing System

The processing system consists of two separate mobile units, a trailerable filtration unit (called the HEPA trailer) and a trailerable blower unit (called the blower trailer). The general functions of these two trailers is to create the vacuum necessary to extract the carbon tetrachloride laden soil gas from the well field, remove moisture and particulate from the soil gas, disburse it to a collection system to strip the carbon tetrachloride from the soil gas (Section 2.3.4) and then release the remaining soil gas to the atmosphere.

2.3.2.1 HEPA Trailer. The HEPA trailer manifold receives the soil vapor via hose(s) from the extraction well(s). The manifold combines the soil vapor from all the wells. The flow path is through the HEPA filters which remove particulates from the soil vapor. The filtered soil vapor exits the HEPA filters and leaves the HEPA trailer and goes to the blower trailer.

The HEPA trailer is leveled with installed jacks and grounded with two sets of grounding rods. The physical layout is shown in Figures 2-10 and 2-11. The HEPA filter housing is shown in Figure 2-12. The HEPA trailer components are described below.

The function of the trailer is to provide a container for the components and allow them to be part of a mobile system. The trailer consists of a 20- by 8-ft steel frame bed with steel grated flooring, four wheels, and tongue. Components are mounted using unistrut and bolts. The trailer is leveled with installed jacks and grounded with two sets of grounding rods.

2.3.2.2 HEPA Trailer Manifold. The HEPA trailer manifold connects to the extraction well(s) via transfer hose(s). The connections of the hoses to the manifold are made with positive seal quick-release fittings. Valves on the manifold provide control of the flow from each well.

The manifold has several instruments. A flow meter and vacuum pressure transmitter are placed in each manifold inlet segment and a pressure gage allows a visual indication of the pressure. A relative humidity transmitter and temperature transmitter is located in the header portion of the manifold. If moisture in the soil vapor is excessive, the soil vapor is then directed to a water knockout tank. The liquid will be collected and disposed of as purge water. Specifications for HEPA trailer manifold are listed in Figure 2-13.

The function of the trailer manifold is to connect the transfer hoses from the well field to the processing system. Vapor from the manifold will be combined into one pipe, then routed to the filtration elements directly or via the water knockout tank (located on the blower trailer).

There are four inlet segments on the manifold which receive the well field transfer hoses. Each connection from the transfer hoses to the manifold nozzles will be a positive seal quick-release fitting. A valve is located at the inlet of each segment to provide containment when a hose is not connected and to provide flow control.

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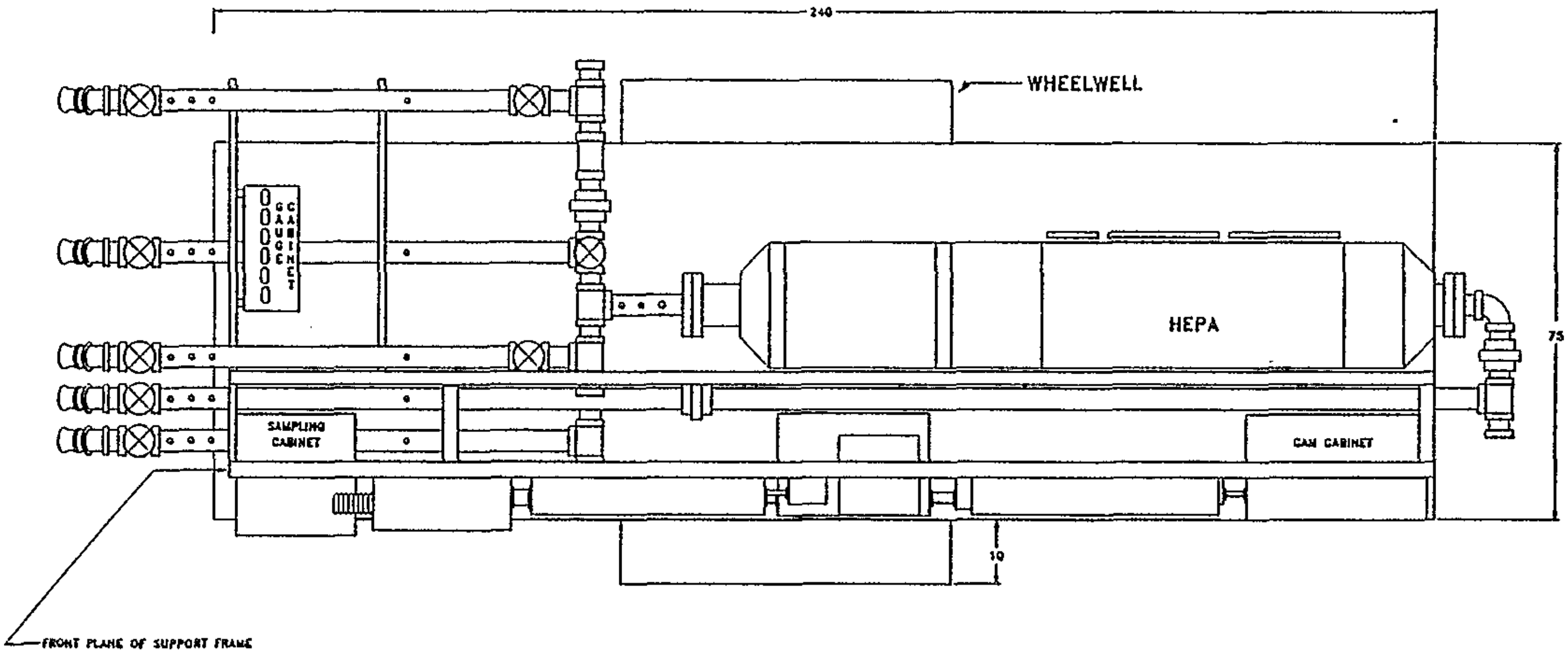


TOP VIEW

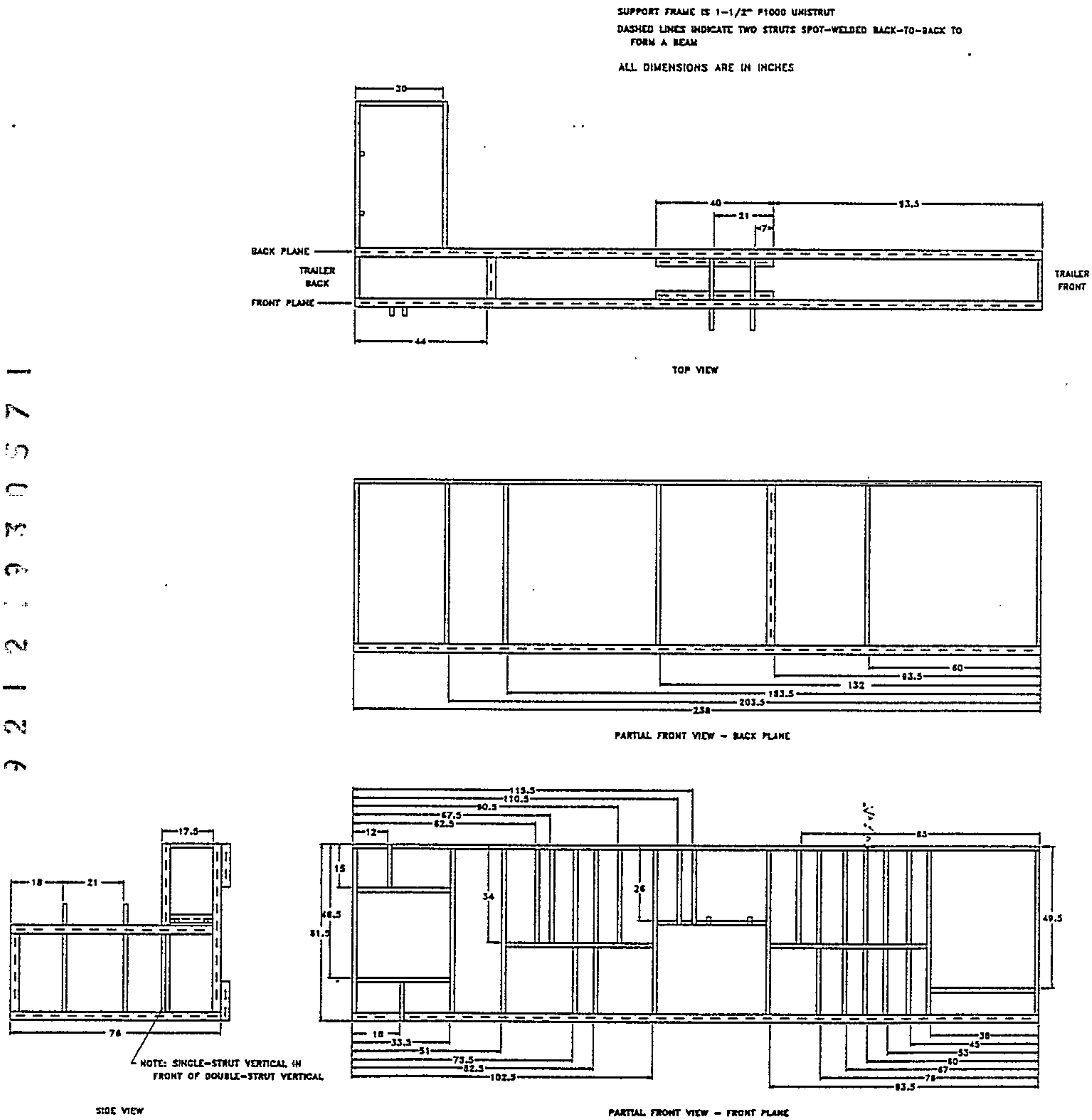
NOTE:

TRAILER WIDTH AT WIDEST POINT IS 98 INCHES (8 FT 2 IN)

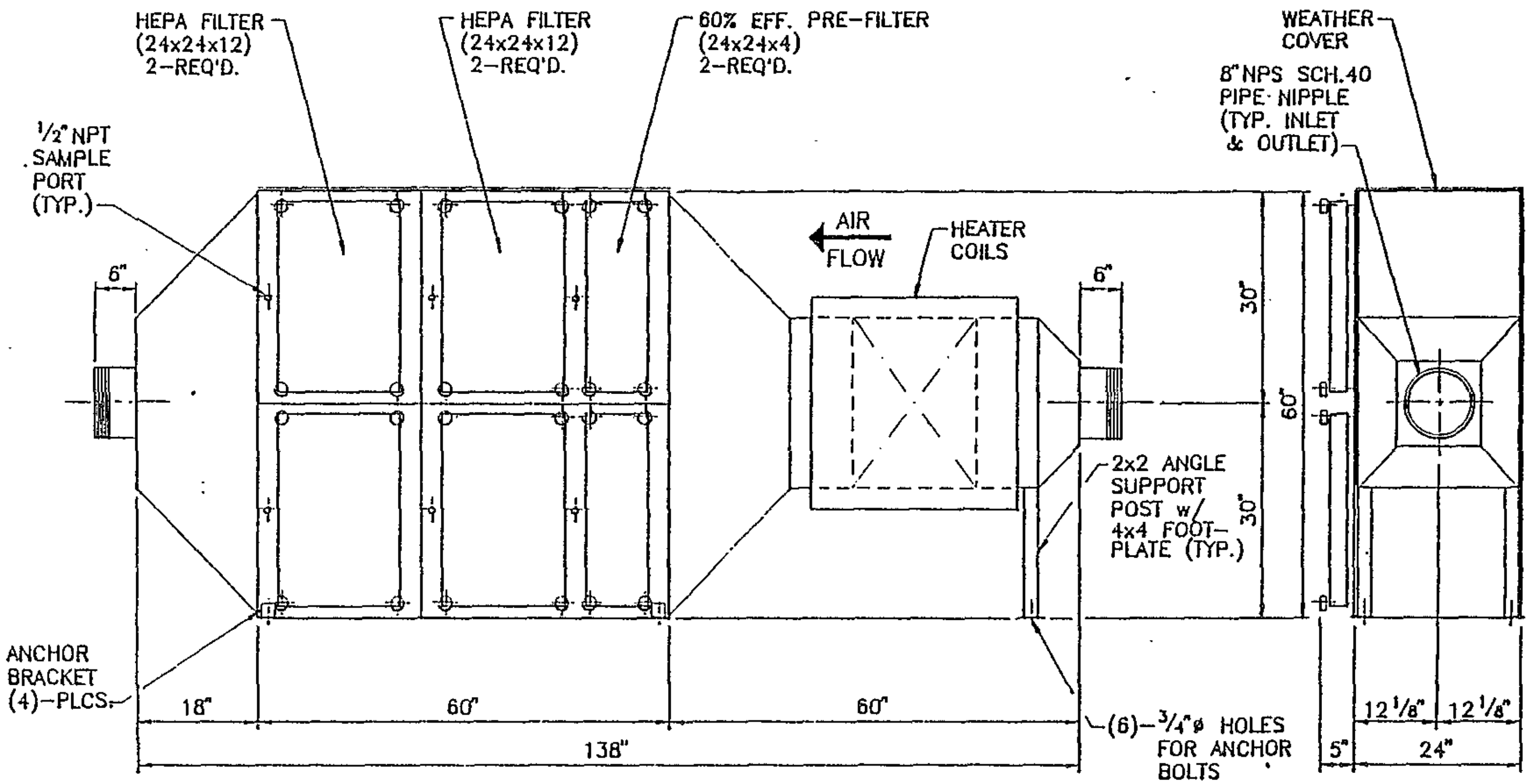
ALL DIMENSION ARE INCHES

Figure 2-10. HEPA Trailer - Top View.

Figure 2-11. HEPA Trailer Support.



9 2 1 2 4 9 3 0 5 7 2

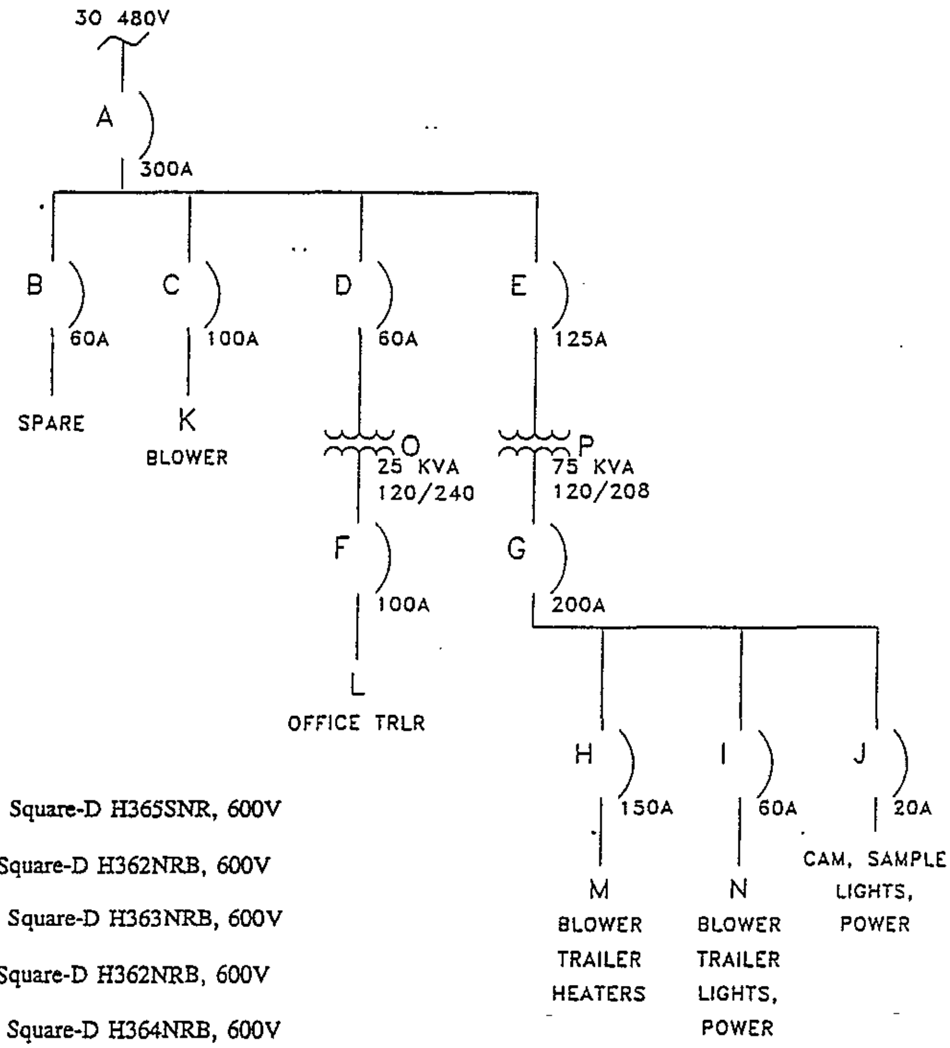


NOTES: 1.) MATERIAL- 304 ST.STL. (14 GA. MIN)
(REINFORCED WITH STRUCTURAL ANGLES)
2.) INSTALLED WT.(APPROX.) 1180 LBS.
3.) CAPACITY- 1500 SCFM
4.) UNIT SHALL BE DESIGNED TO WITHSTAND
-10" Hg VACUUM. (-136" W.G.)

SCALE 1=16

Figure 2-12. HEPA Filter Housing.

Figure 2-13. HEPA Trailer Electrical One-Line.



KEY

A. 400 Amp Safety Switch, Square-D H365SNR, 600V

B. 60 Amp Safety Switch, Square-D H362NRB, 600V

C. 100 Amp Safety Switch, Square-D H363NRB, 600V

D. 60 Amp Safety Switch, Square-D H362NRB, 600V

E. 200 Amp Safety Switch, Square-D H364NRB, 600V

F. 100 Amp Safety Switch, Square-D H323NRB, 240V

G. 200 Amp Safety Switch, Square-D H324NRB, 240V

H. 200 Amp Safety Switch, Square-D H324NRB, 240V

I. 60 Amp Safety Switch, Square-D H322NRB, 240V

J. Load Center 120/240V, Q02L40RB

K. 100 Amp Receptacle, Appleton ACJA1034-150

L. 100 Amp Receptacle, Appleton ACJA1034-150

M. 200 Amp Receptacle, Appleton AJ420034-150

N. 60 Amp Receptacle, Appleton ACRE6034-125

O. 25 KVA Transformer, Square-D 25S3H, 480V/120-240V

P. 75 KVA Transformer , Square-D 75T3H-0, 480V/120-208V

2.3.2.3 HEPA Filtration Unit. The HEPA filtration unit removes particulates from the soil gas. The HEPA filtration unit consists of a prefilter and two filter banks in series. Detailed specifications for the HEPA filtration unit are given in Appendix A. The function of the filtration unit is to remove particulates from the soil-gas stream, including potentially radiologically contaminated particu-lates. The prefilter functions as a roughing filter to remove large partic-ulates. The HEPA filters are rated at 99.97% efficient for particles 0.3 μ or greater.

The HEPA housing instrumentation includes differential pressure gages across each of the filter banks and an alpha CAM and beta CAM measuring the radiation between the two filter banks. The CAM have individual audiovisual alarms. They also send alarm information to the data logging computer, which has a high level alarm and can shut down the VES system if necessary.

2.3.2.4 HEPA Trailer Sampling System. The sampling system consists of a sampling cabinet located on the HEPA trailer, tubing to and from the cabinet, a sampling pump (if required), and seven sampling ports. The sampling system is used to obtain samples to send to a laboratory for analysis. The HEPA trailer sampling cabinet provides a working space and weather protection for sampling activities. It allows soil vapor from each well to be sampled.

The sampling system tubing connects the sampling cabinet to the sampling ports. The tubing material is stainless steel and does not interfere with the sample quality. The tubing connections (fittings and valves) provide access and control at all desired locations. The tubing is shown in Figure 2-14. As shown in the figure, the sampling ports are located on each of the four incoming well field lines, on the water separator lines, and on the HEPA trailer effluent line.

A sampling pump is used to pull a vacuum to obtain soil vapor samples. It is a 110-V, single-phase, motor-driven pump.

2.3.2.5 HEPA Trailer Electrical. Electrical service requirements and sketches for the HEPA trailer electrical system are shown in Appendix A.

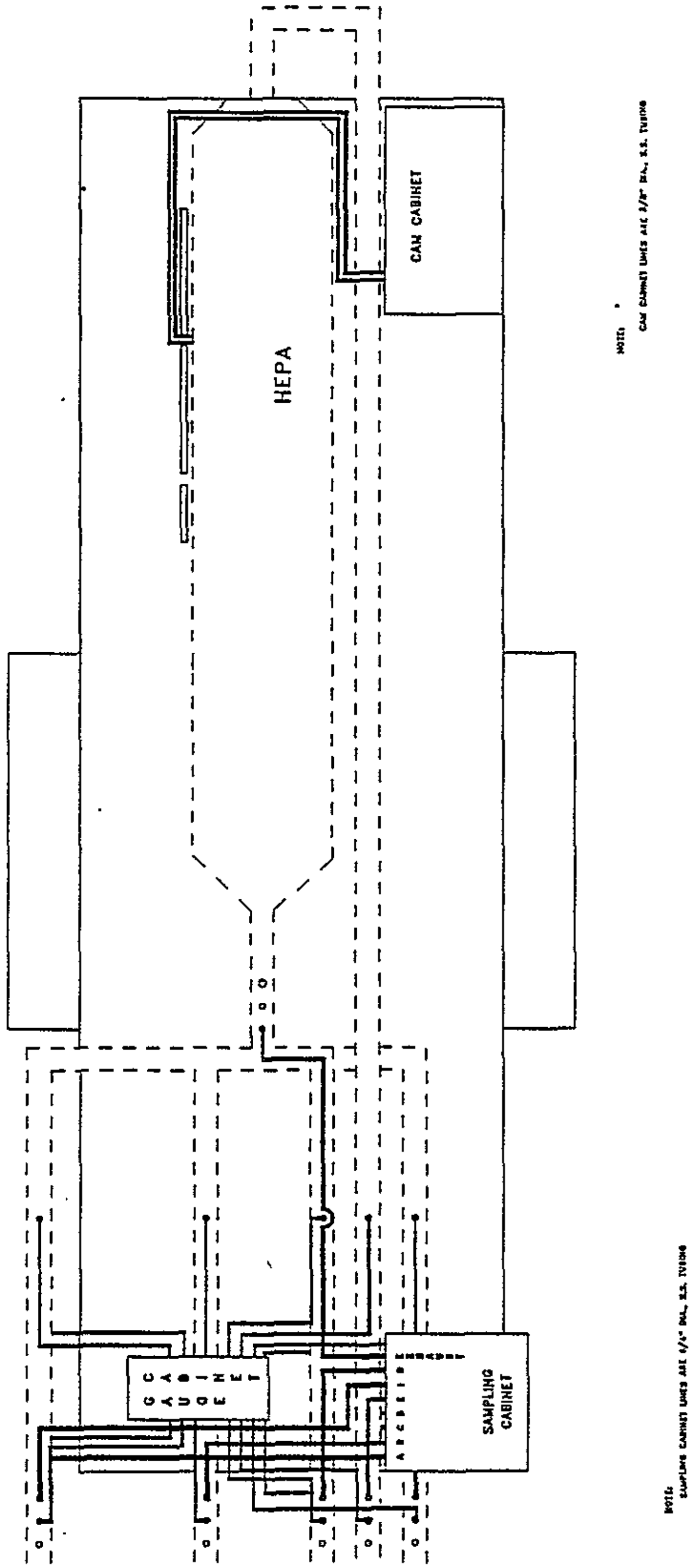
2.3.2.6 HEPA Trailer Piping and Transfer Hose. The HEPA trailer piping layout is shown in Figure 2-15. The specifications for the piping system are given in Appendix A.

2.3.2.7 HEPA Trailer Lights. The HEPA trailer has pole-mounted lights for nighttime use. The specifications for the lights are given in Appendix A.

2.3.3 Blower Trailer

The blower trailer equipment processes the exhaust from the HEPA trailer. It includes the blower, water knockout tank, stack, and piping. The trailer has a tongue jack and is grounded with two grounding rods. The trailer layout is shown in Figure 2-16.

Figure 2-14. HEPA Trailer Sample Lines.



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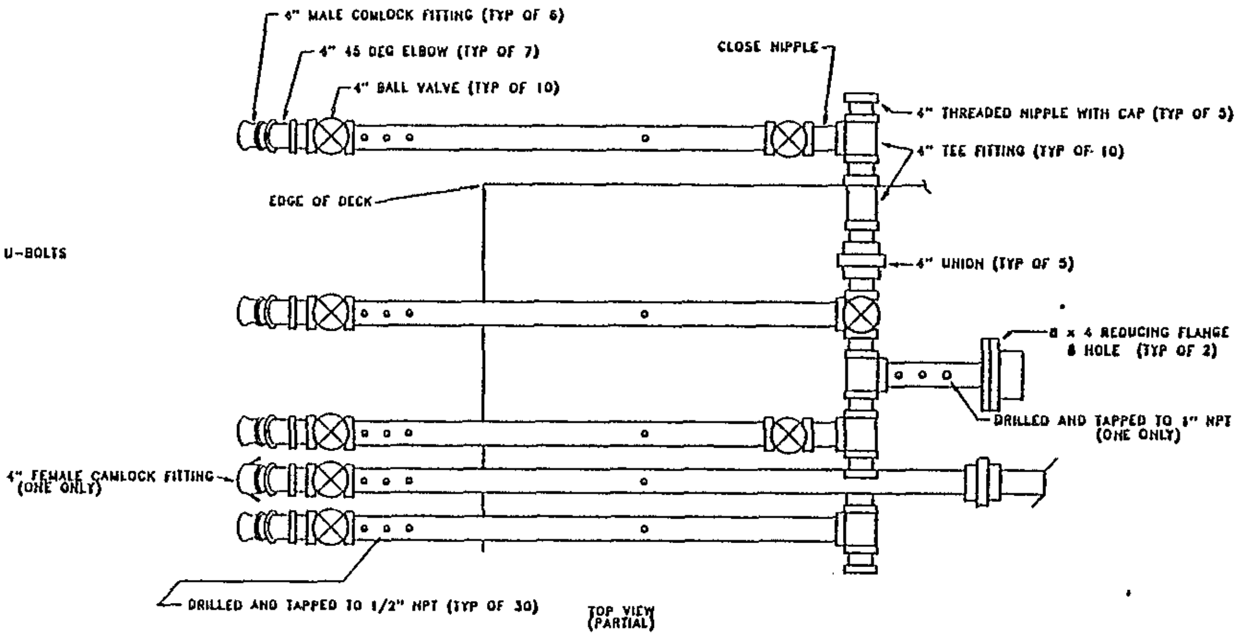
NOTES:

PIPES A, B, C, D ARE FROM THE WELLFIELD
PIPE E IS THE EFFLUENT
PIPE O GOES OUT TO WATER SEPARATOR
PIPE I IS IN FROM WATER SEPARATOR

ALL PIPE IS 4" DIA. 40S, C.S.

PIPE IS FASTENED TO DECK AND SUPPORT STRUTS WITH U-BOLTS

ALL DIMENSIONS ARE IN INCHES



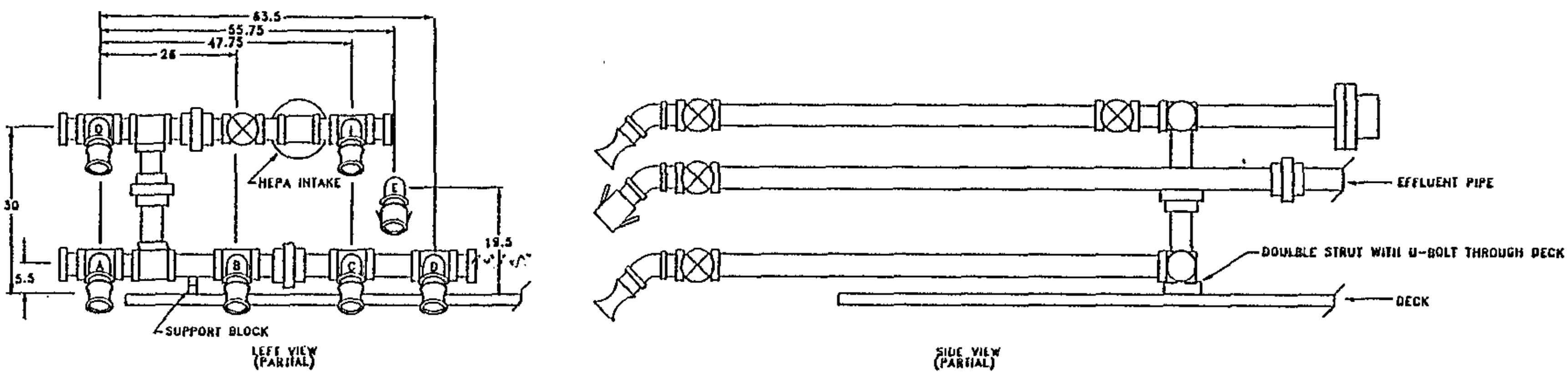


Figure 2-15. HEPA Trailer Piping.

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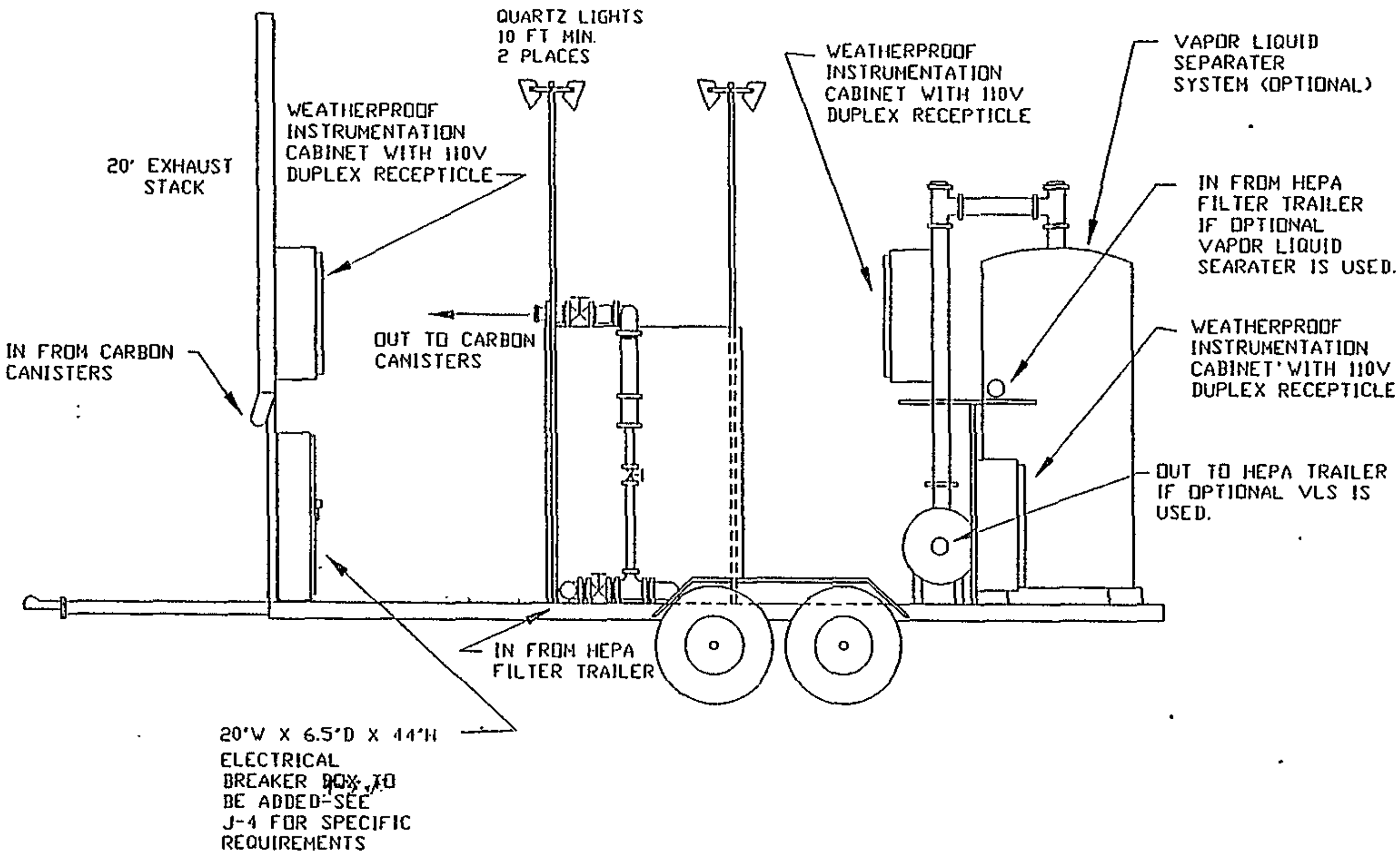

Figure 2-16. Blower Trailer.

The blower trailer serves two main purposes: (1) it provides the blower, which induces the vacuum in the well field and extracts the carbon tetrachloride-laden vapor and moves the vapor throughout the system; and (2) it provides for the release of the soil gas after the soil gas has passed through the treatment system. Additionaly, it can be used to reduce the moisture content of the soil gas before the soil gas passes through the HEPA filters. The blower trailer consists of: (1) trailer, (2) water knockout tank, (3) air preheater, (4) blower, (5) sampling ports and monitoring cabinets, (6) piping and hoses, (7) lighting, (8) instrumentation, (9) stack, and (10) electrical enclosures and conduit (Figure 2-16). The function of each of the components and subcomponents are described below. Detailed sketches and specifications are provided in Appendix A.

2.3.3.1 Trailer. The trailer provides a container for the component and allows the system to be mobile. The trailer is 16 by 8 ft and has four wheels. It is steel framed and has a wooden deck.

2.3.3.2 Blower. The blower creates the airflow and vacuum for the entire system. The blower is located on the blower trailer. It is the only moving part in the VES. It pulls the soil vapor from the subsurface of the well fields, through the HEPA filters, and into the blower. Then it pushes the soil vapor through the GAC canisters and through the stack to the atmosphere. The blower specifications are given in Appendix A.

2.3.3.3 Water Knockout Tank. The moisture in the soil gas may be reduced with the use of the water knockout tank. Removal of the moisture may enhance the effectiveness of the HEPA filters and the GAC. The water knockout tank functions by decreasing the velocity of the vapor stream, thus allowing the free moisture to drop out and collect in the tank. The water knockout tank is used optionally, when it is determined that excessive moisture is present in the system.

The water knockout tank measures 6 ft high and is 3 ft in diameter and has a demoister. The moisture collected in the tank is collected from the tank, sampled, and is disposed of as purge water. As this portion of the system is upstream from the HEPA filters, it is treated as a radiologically controlled zone.

2.3.3.4 Electric Air Preheater. The electric air preheater is located just down stream of the water knockout tank to further reduce the relative humidity in the soil gas to further vaporize any moisture present in the system before it flows back to HEPA filters. Based on a safety assessment, there is a concern that the preheater could cause the production of phosgene gas when heating the carbon tetrachloride vapor at temperatures of exceeding 400°F. Therefore, the preheater will not be used during preliminary operations. However, the unit remains in place for future use, if required. The heater will be used only after approval is granted by Safety Assurance.

2.3.3.5 Blower Trailer Instrumentation. All blower trailer instrument transmitters connect to the process control system. General specifications for the instruments are listed in Appendix A.

2.3.3.6 Blower Trailer Electrical Service. Electrical service requirements for the blower trailer are listed in Appendix A.

2.3.3.7 Exhaust Stack. The exhaust stack receives the soil gas from the treatment system and exhausts it to the atmosphere. The stack is double-walled steel and is 6 inches in diameter and rises 20 ft above the ground surface. The stack is equipped with a flow meter, pressure transducer, and compliance recorder. The stack is supported by four guywires.

2.3.3.8 Blower Trailer Piping and Transfer Hose. The blower trailer piping layout is shown in Figure 2-17.

All of the connections, piping, fitting, and hoses associated with the soil gas flow on the blower trailer are nominal 4-inch diameter and are fitted with national pipe threads. The piping is carbon steel and the hoses are wire reinforced.

The blower trailer has quick connect fittings for the inlet and outlet connections to hoses. One inlet is where the main flow enters the blower after discharging from the HEPA trailer. A second inlet and an accompanying out are part of the water knockout tank. A third inlet and an accompanying outlet are the effluent from the blower out to the treatment system and back in to the base of the exhaust stack.

2.3.3.9 Instrumentation. The instrumentation on the blower trailer includes pressure gages, a temperature gage, a thermocouple, a flow meter, carbon tetrachloride detectors, and radon detectors. Sample ports provide a means of sampling the soil gas. A compliance recorder on the exhaust stack provides a record sample of the particulate radiation released from the stack.

2.3.3.10 Lighting. The blower trailer has pole-mounted lights for nighttime use. The specifications for the lights are given in Appendix A.

2.3.3.11 Electrical. The electrical requirements and components for the blower trailer are discussed in Appendix A.

2.3.4 Treatment System

The treatment system consists of a minimum of two GAC canisters placed in series. The activated carbon in the canisters adsorbs the contaminant vapor molecules. The first GAC canister functions as the primary treatment system and the second functions as the polishing system. When the primary canister reaches its sorptive capacity, it is taken offline to be regenerated. It is replaced immediately by the secondary canister. A regenerated canister replaces the secondary canister.

2.3.4.1 Canisters. The canisters hold 500 to 2,500 lb of GAC and are rated for at least 500 ft^3/min flow between 0 amd 5 lb/in^2. The canisters are equipped with 4-inch threaded fittings to which quick connect fittings are attached. The inlet and outlet of each canister are equipped with valves for sealing the canister during non-use.

2.3.4.2 Hoses. The hoses used in the treatment system are the same as those used in the rest of the VES. The hoses are 4-inch diameter wire reinforced with ends fitted with quick connect fittings.

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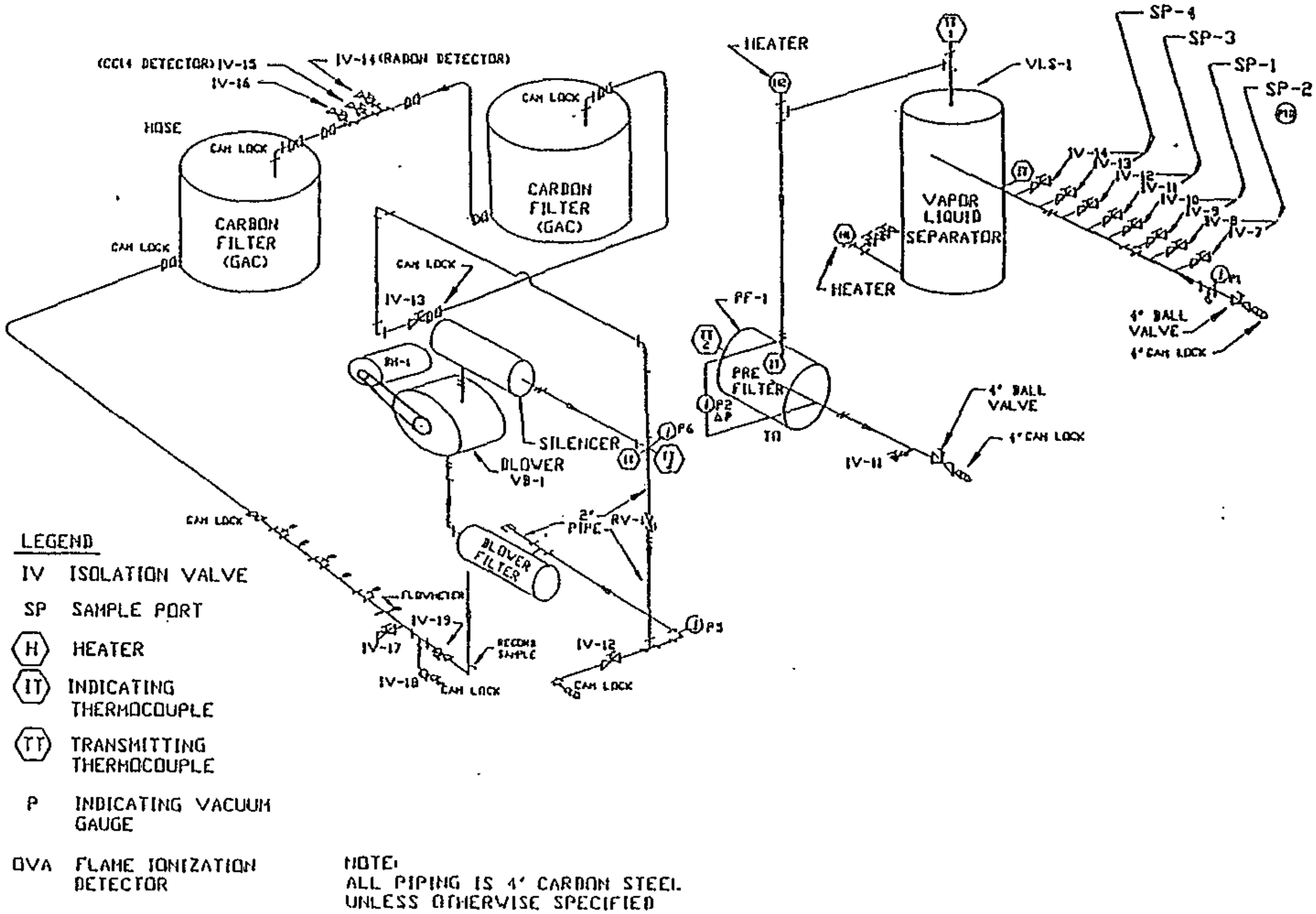

Figure 2-17. Blower Trailer Piping.

2.3.5 Office Trailer

The office trailer provides working space for the project support personnel at the site, storage space for some items, and housing for the process control system computer. The office trailer also holds the site files. The office trailer is a standard single-wide trailer with heating and air conditioning. The trailer is blocked and tied down.

2.3.6 Area Requirements

The VES has a process area which includes the area encompassing the well fields, the process trailers, the office trailer, and the GAC canisters. It has exclusive use and limited access for the project duration. The process area is barricaded to prevent unauthorized access.

For the handling of the GAC canisters, there are three separate areas. The first area is where the GAC canisters are stored on receipt at the site. The second area is where the GAC canisters are actually in use as the treatment system. The third area is a holding location prior to offsite shipment of the GAC canisters. In all three areas, the GAC canisters must be kept a minimum of 25 ft from any electrical generator and 50 ft from any fuel source for an electrical generator.

2.4 SAFETY REQUIREMENTS

Reasonable precautions are undertaken during VES installation and operation to protect the health and safety of all involved personnel. Standard radiation protection procedures are followed, and personnel will be protected to keep radiation exposure to as low as reasonably achievable (ALARA). The project support area is accessible only to authorized personnel and emergency vehicles. Emergency evacuation routes will not be obstructed. A zone of 50 ft around the process equipment will be maintained by rope to prevent inadvertent access by uninvolved individuals.

A health and safety plan is provided in Appendix E. A site-specific Hazardous Waste Operations Permit has been produced as well.

This project is classified as Westinghouse Hanford safety class III to ensure the safety of site workers. It is designed to meet requirements of the National Electric Code (NEC), Occupational Safety and Health Administration (OSHA), applicable environmental regulations, and the Safety Assessment.

The safety equipment list (Table 2-4) provides a com-prehensive list of safety systems and equipment requiring particular care, use, and maintenance attention to ensure safe carbon tetrachloride remediation operations.

Table 2-4. Safety Equipment List.

Equipment Description	Location	Code
Alarm Systems:	Site computer	
Continuous Air Monitors		ER
High Carbon Tetrachloride		EI
High Flow Differential		EI
High Temperature		EI
High Vacuum		EI
Low Flow		EI
Low Pressure		EI
Compliance Recorder	Blower trailer	ER
Continuous Air Monitors	HEPA trailer	ER
Final Carbon Tetrachloride Meter	Blower trailer	EI
HEPA Filter Delta P Gages	HEPA trailer	ER
Radon Detectors	Blower trailer	IR
Shutdown Relays	Blower trailer	EIR

KEY:
E = Environmental Protection
I = Industrial Safety
R = Radiation Protection

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3.0 OPERATIONS AND MAINTENANCE

The process control system controls the test unit operation. The system instrumentation provides input to the process control system. These inputs create control responses. Operational experience will allow the instrumentation and control logic to be altered to improve system efficiency. Operational control specifications are listed in Appendix D.

3.1 PROCESS CONTROL SYSTEM DESCRIPTION

The process control system includes the VES computer control logic and equipment. Input is provided by electronic indicating transmitters, wiring, and a computer (Figure 3-1). Transmitters send electronic signals to the computer. This provides the computer with inputs for system operational control, recording unplanned events (alarms), and system performance analysis.

The computer is located in the office trailer and allows site personnel to access information from the transmitting instruments and make control changes. The computer uses various instrument inputs to control the heaters and the blower. The control limits depend on current system configuration.

3.1.1 Radiation Inputs

Particulate radiation is measured by CAM between the HEPA filter banks. This location is for process control. The CAM inputs radiation data to the process control system. The CAM have individual audiovisual alarms, and also input to the process control system alarm system. The alarm system shuts down the VES in the event radiation level set points are exceeded.

3.1.2 Carbon Tetrachloride Input

The soil vapor carbon tetrachloride concentration measurements are made before, between, and after the GAC canisters. The process control system records these measurements for compliance monitoring and system trend analysis.

3.1.3 Radon Detectors

The soil vapor radon measurements are made before, between, and after the GAC canisters. The process control system may record these measurements for compliance monitoring and system trend analysis or the measurements may be manually read and recorded.

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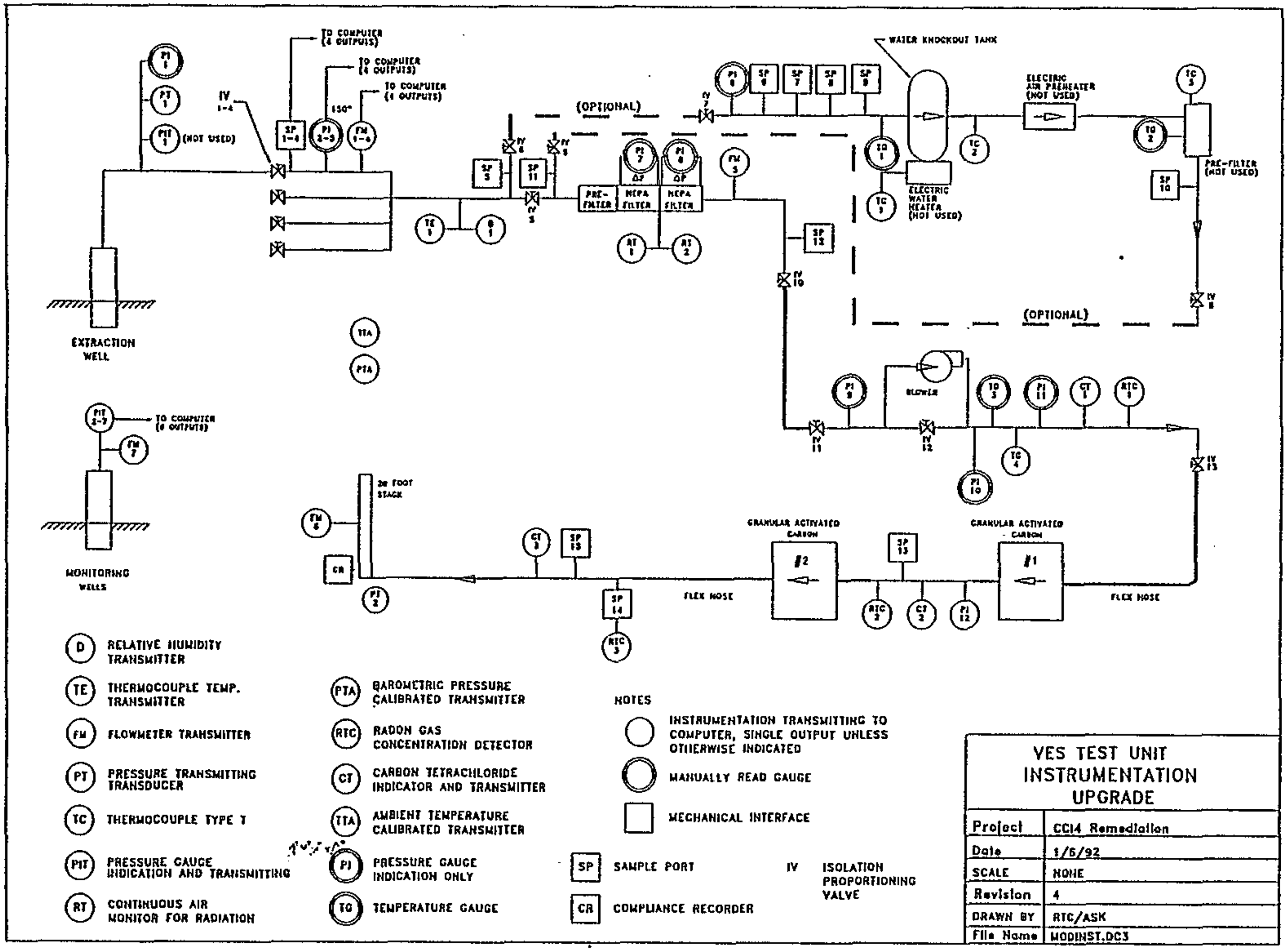


Figure 3-1. VES Test Unit Instrumentation.

3.1.4 Temperature Inputs

The temperature inputs are needed for heater control and safety compliance. The process control system temperature measurement locations are near the wellheads, the HEPA filter housing inlet, and downstream of the blower. Both manually read gages and electronic transmitting gages are used to measure the temperature.

3.1.5 Pressure Inputs

The process control vacuum pressure measurement locations are at each well interval and on both sides of the HEPA filtration unit. The blower exhaust pressure is measured and barometric pressure is used for well performance analysis. The vacuum pressures vary widely at the well intervals and in the well hoses. Several pressure gages are used to cover the broad vacuum pressure range (0 to 150 inches of water). Electronic indicating transmitters are used to measure the pressure inputs.

3.1.6 Flow Input

Flow rate measurements are taken in three separate sections of the system. The first section is the incoming lines of the HEPA trailer manifold, which provides the flow rate from each well. The second section is the flow into the HEPA filtration unit, which gives the total flow from all the wells under extraction. The third section is the exhaust stack on the blower trailer, which also gives the total flow from all the wells under extraction. Electronic indicating transmitters are used to measure the flow input.

3.1.7 Relative Humidity Input

The relative humidity measurement is upstream of the HEPA filter housing and is used to control the vapor stream dewpoint to prevent condensation.

3.2 SITE DESIGN

3.2.1 Site Configuration

The process equipment of the VES is situated outside the fence at the south end of the 216-Z-1A Tile Field. The HEPA trailer and blower trailer are placed in close proximity to each other and are interconnected with hoses, electrical cables, and instrumentation cables. The office trailer is placed approximately 75 ft from the other trailers and is interconnected to them with electrical cables and instrumentation cables.

The GAC canisters in use as the treatment system are placed adjacent to the blower trailer and are connected to the trailer by hoses. Separate staging areas exist for unused GAC canisters and for canisters that have been used as the treatment system. The GAC canisters in use and the canisters that have been used are roped off in their respective areas as Radiation Control Zones because of the activity associated with them due to radon daughter products.

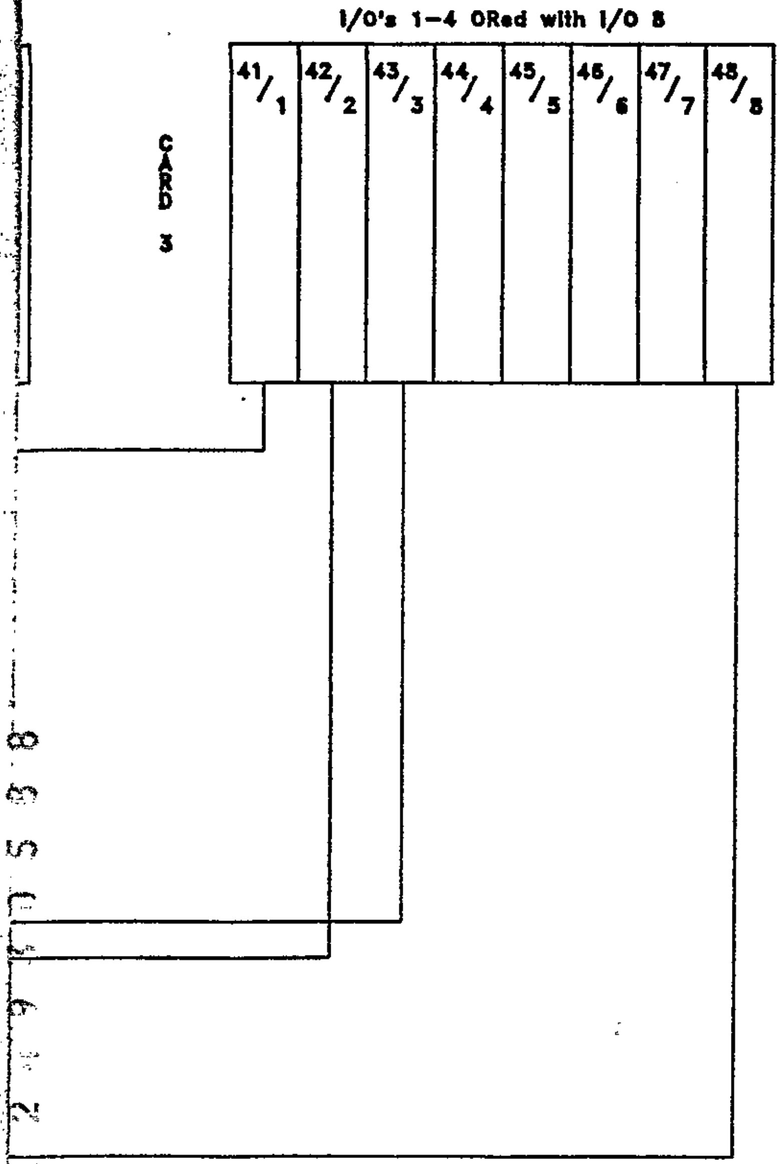
3.2.2 Power and Electrical

The VES uses electrical power brought in on overhead lines to the site. The pole power is converted by a transformer at the base of the pole and an underground cable is supplied to the main electrical connection on the HEPA trailer.

3.3 CONTROL LOGIC

The control logic allows the system to operate within established parameters without constant surveillance by site personnel. The control logic incudes the alarm set points, the alarm response logic, and failure modes and responses. A system shutdown consists of shutting the blower off. The control logic shutdown responses are listed below. The alarm response logic is shown in Figure 3-2. During the initial startup phase, not all of the alarm set points and alarm response logic will be used.

- If the carbon tetrachloride levels before or after the first GAC canister >2,000 ppm, the system shuts down.
- If the carbon tetrachloride effluent levels are above 25 ppm, the system shuts down.
- If the relative humidity is above 98%, the system shuts down.
- If the process inlet temperature is >200°F, the system shuts down.
- If the hose heater outlet is >225°F, the system shuts down.
- If the blower exhaust temperature >225°F, the system shuts down.
- If the vacuum is above 135.8 inches of water, the system shuts down.
- If the flow rate out the stack >500 ft^3/min, the system shuts down.
- If the differential of flow rates between FM5 and FM6 is >10% beyond the range of accuracy of each instrument, the system shuts down.
- If the blower exhaust pressure >5 lb/in^2, the system shuts down.
- If the alpha CAM measures 1.602 log counts, the system shuts down.
- If the beta CAM measures >3.69 log counts, the system shuts down.
- If the radon levels before or after the last GAC canister are above 4236 pCi/L, the system shuts down.



DATA ACQUISITION SYSTEM FLOW DIAGRAM	
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3.4 ALARM LOGIC

3.4.1 Alarm Set Points

The alarm set points include the set points required by the SAR and may be further defined during the initial startup phase. It is expected that the alarm set points will change as experience dictates. Changes made to the alarm set points via the computer are documented on the daily checklist. The alarm set points are defined in Appendix D.1.

Some time limitations may be programmed into the alarm logic. An example is programming an alarm response time delay for a specified time period before the alarm response logic is activated. This avoids alarms due to power spikes or other momentary sources of no consequence. Additionally, the alarm response of the CAM may be modified by the measured radon levels.

3.4.2 Alarm Response Logic

The process control system alarm logic shuts down the system by stopping the blower. The automatic shutdown responses are listed in Appendix D.1. The system stays shut down until the problem is corrected by a technician. The alarm appears on the system computer screen. An authorized person makes input to the process control system to start the system up. The daily checklist is used to record the alarm event, the event date and time, the event duration, the corrective action, and the name of the person taking the corrective action.

3.4.3 Control Points

There are several control points within the VES that provide operational control. The control points of the test unit are as follows:

- Wellhead
  - control well vacuum and flow rate
- HEPA Trailer Manifold
  - control well vacuum and flow rate
  - control carbon tetrachloride concentration levels
  - control relative humidity of soil gas
- Vacuum Blower
  - control system vacuum and flow range
  - turn power on/off.

3.5 SYSTEM OPERATION

The VES operation removes carbon tetrachloride from the subsurface, filters particles from the soil vapor, removes carbon tetrachloride and other VOC from the soil vapor, and vents the remaining vapor to the atmosphere (Appendix D.2). Additionally, the VES operation includes sampling of the soil vapor at various stages in its processing.

3.5.1 Standard Operation Mode

Following the initial testing and startup phase, operation of the VES includes continuous process monitoring and flow adjustment. Occasional control logic changes are made at the VES site by utilizing the computer. These changes are recorded in the historical subroutine.

There will be daily operating site inspections. Personnel performing these daily walkthrough inspections are given a detailed checklist.

3.5.2 Sampling Procedures

Sampling frequency is based on the monitoring plan described in Chapter 4. It varies at different locations for several reasons. These reasons are as follows:

- Identification and quantification of soil vapor airflow constituents.
- Identification and quantification of GAC effluent constituents.
- Information to determine system effectiveness and trends.

The sampling discussed here is air sample collection and analysis using laboratory-grade equipment.

3.5.2.1 Data Collection Points. The system has several data collection sampling points. These points are at the four incoming well field lines, the water separator lines, the HEPA trailer effluent line, and the exhaust stack.

3.5.2.2 Data Analysis. Sampling information will interrelate with the system instrumentation information for data trend analyses. This will be performed per the monitoring plan.

3.5.2.3 Well Tracers. Tracers may be used during system operation to provide perforated interval short-circuit information. This information is useful for estimating subsurface preferential flow paths and flow rates. The flow path and flow rate data combined with the data trend analyses provides a basis for operational changes. The tracers will also improve the well field modeling analysis to better understand the soil plume.

3.6 SYSTEM MAINTENANCE

System instrumentation calibration and equipment preventive maintenance performance use an established schedule. There is minimal system down time due to scheduled maintenance activities. See Appendix D for maintenance specifications.

3.6.1 Routine Maintenance

The system and component designs allow easy access for maintenance. This includes provisions for accessing the equipment, removing equipment and material, lubricating the equipment, and performing diagnostic tests.

3.6.2 Calibration Maintenance

Instrumentation calibration is performed on routine and as-needed basis. Detailed calibration procedures and intervals will be established prior to operation. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

As part of the calibration maintenance, weekly operability checks and monthly alarm system functional checks are performed as detailed in Appendix D.

3.6.3 Preventive Maintenance

Preventive maintenance includes inspection, testing, and system overhaul. Regular performance, following manufacture's instructions, reduces in-service failures and retards system deterioration.

3.6.3.1 Component Maintenance Frequency. The component maintenance frequency is shown in Appendix D. The equipment maintenance frequency matches the equipment procured.

3.6.3.2 Spare Parts List and Site Inventory Requirements. Consumable spare parts (e.g., drive belts, fuses, filter elements, etc.) are available as store stock items and will not be kept on hand. Spare carbon tetrachloride detector probes will be kept by Westinghouse Hanord Environmental Field Services Group.

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4.0 MONITORING

During the soil vapor extraction at the 216-Z-1A Tile Field, the well field (and environs) and the VES test unit will be monitored primarily to measure the performance of vapor extraction. Evaluation of results will be used to: (1) assist in optimizing the VES design and operations; (2) comply with regulatory and Hanford air and GAC release criteria; and (3) conduct operations and monitoring safely. The monitoring program detailed in this section has been designed for the 216-Z-1A Tile Field remediation; however, baseline monitoring also incorporates areas covering the 216-Z-9 Trench and the 216-Z-18 Crib (Figure 4-1). The monitoring program may be modified throughout operations.

Sampling and analysis will be conducted per the Quality Assurance Project Plan (Appendix B), Project Management Plan (Appendix C), the Health and Safety Plan (Appendix E), the Sampling and Analysis Plan (Appendix F), and the Data Management Plan (Appendix G).

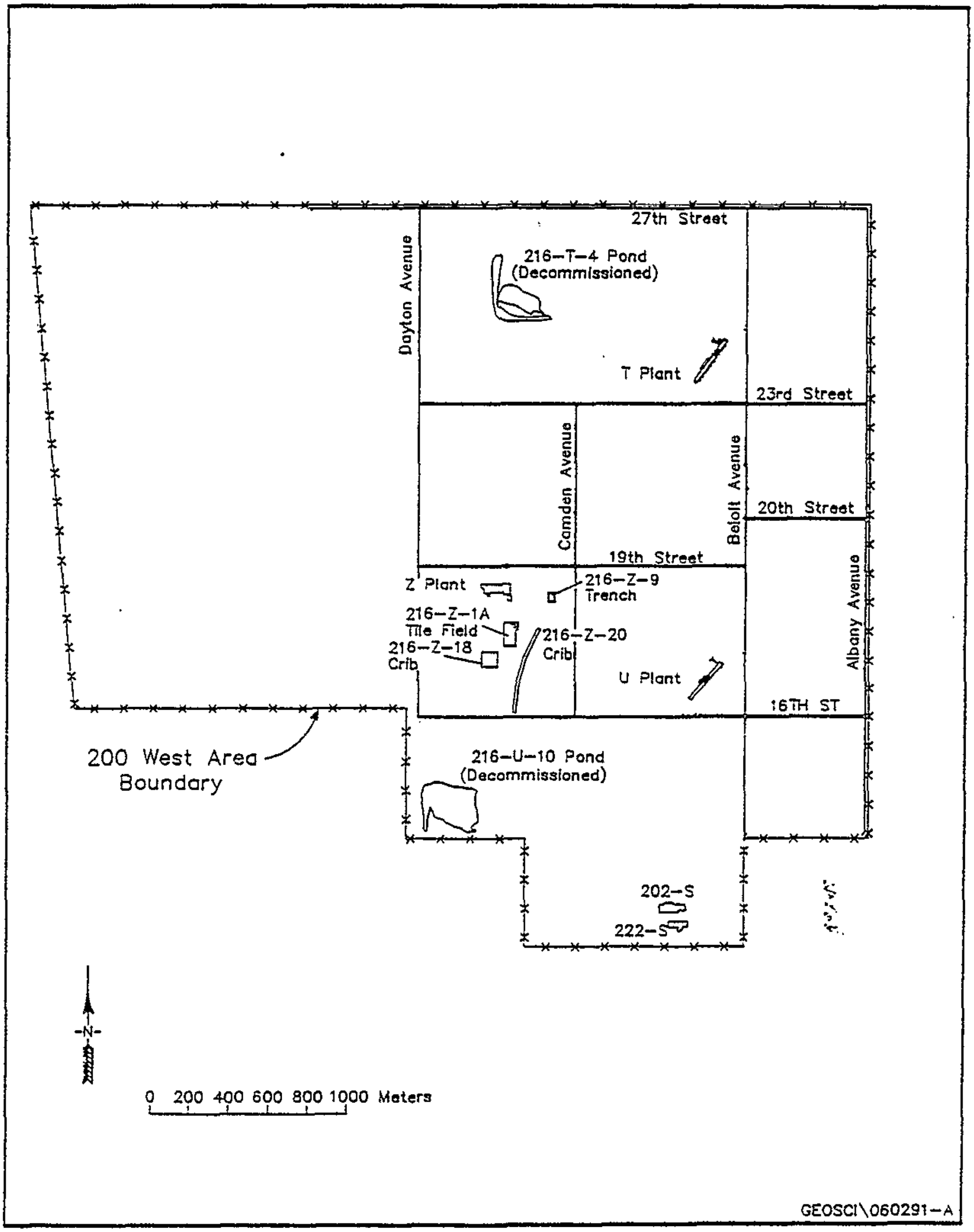
4.1 SUBSURFACE MONITORING

The objectives of subsurface monitoring are as follows:

- Measure the existing concentrations of carbon tetrachloride and other contaminants in the subsurface prior to initiation of the vacuum extraction.
- Investigate how the existing concentrations of carbon tetrachloride and other contaminants vary with time.
- Evaluate the impact of vapor extraction on the distribution and concentrations of carbon tetrachloride and other contaminants in the subsurface.
- Optimize the extraction of carbon tetrachloride vapor from the subsurface.
- Help establish a healthy and safe working environment.

These objectives will be met through two subsurface monitoring programs: baseline monitoring and well field monitoring. Baseline monitoring will include measurement of existing carbon tetrachloride vapor and radon concentrations from a variety of depths in the unsaturated zone and measurement of existing carbon tetrachloride and chloroform concentrations in groundwater. These measurements will be repeated at regular intervals to investigate trends in contaminant concentrations. By conducting baseline monitoring before, during, and perhaps after operation of the VES, the data can be used to evaluate the impact of the vacuum extraction on contaminant distributions and concentrations. Data on carbon tetrachloride and radon concentrations are used to address related health and safety concerns.

Figure 4-1. Site Map of 200 West Area.



Well field monitoring will provide data on the distribution of carbon tetrachloride and the permeability of air flow in the vacuum extraction well field. This information will be used to maximize removal of carbon tetrachloride during operation of the VES. It will also be used to recognize and respond to changes in the subsurface environment. The well field components include the vacuum extraction well, monitoring wells, connections, transfer hose, and instruments necessary to link the well field to the rest of the VES.

4.1.1 Baseline Monitoring

Baseline monitoring focuses on measurements of carbon tetrachloride vapor and radon concentrations in the unsaturated zone and of carbon tetrachloride concentrations in groundwater. Sampling points are located in the vicinity of the carbon tetrachloride three disposal facilities (216-Z-1A Tile Field, 216-Z-9 Trench, and 216-Z-18 Crib) and at selected locations throughout the 200 West Area.

4.1.1.1 Unsaturated Zone. Measurements of soil gas in the unsaturated zone are made at existing wells, at soil-gas sampling points, at ground level, and at 200 West Area fencelines. Prior to initiation of vacuum extraction, these measurements are made twice a week. Once an adequate database has been established, the sampling frequency may be reduced at the direction of the project engineer or project scientist. The monitoring plan outlined in this section is intended to provide general guidance for conducting baseline monitoring in the unsaturated zone. Specific procedures and sampling protocol will be refined as the project evolves.

4.1.1.1.1 Wells. Thirty-three existing wells in the vicinity of the three carbon tetrachloride disposal were selected for baseline monitoring of soil gas (Figure 4-2). Samples will be analyzed at each wellhead. In addition, each well may be sampled downhole. The wells were drilled to a variety of depths (Table 4-1) and completed using a variety of construction techniques (Appendix D.3).

Detection and measurement of carbon tetrachloride at the wellhead is performed using an SIP 1000 (tradename of Summit Interests, Lyons, Colorado) photoionization detector (PID) type total organic vapor analyzer (OVA) or equivalent instrument. Because carbon tetrachloride has an ionization energy of 11.25 eV, the SIP must be fitted with an 11.7 eV lamp. The presence of carbon tetrachloride vapor is confirmed by use of a colori-metric tube. Radon present in the gas may be measured with an Eberline RGM III (Pyton Model AB-5 portable radiation monitor made by Pylon Electronic Development Company, Ottawa, Ontario, Canada) radon gas analyzer or equivalent instrument.

The downhole sampling, if performed, may use a teflon tube placed downhole about 6 m (20 ft) to collect the sample. The SIP will be attached to the tube and will remove one volume-equivalent of air before the instrument reading is recorded. The samples may also be analyzed for radon.

Figure 4-2. Locations of Existing Wells Sampled for Baseline Monitoring.

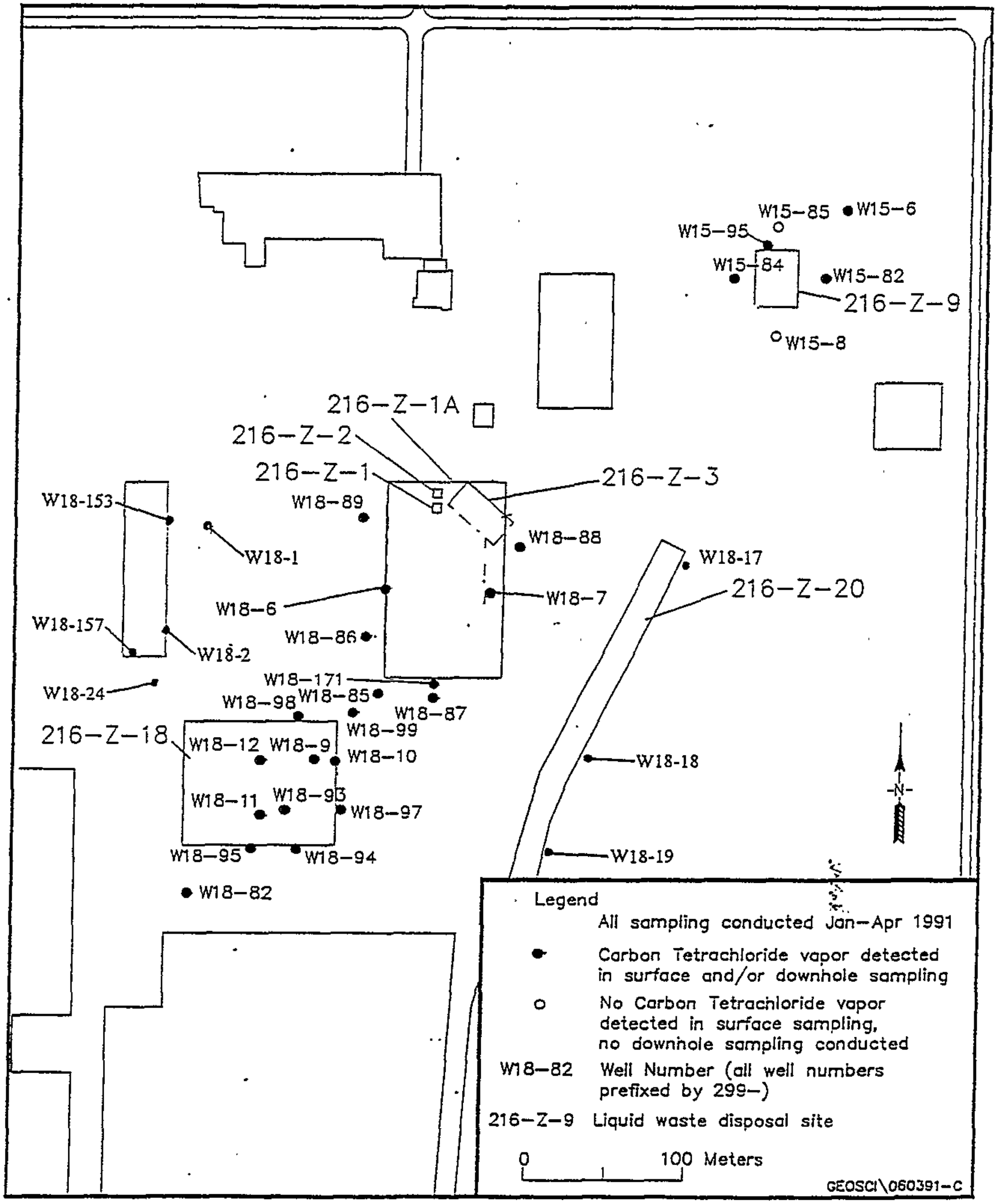


Table 4-1. Construction Details for Existing Wells Sampled for Baseline Monitoring.

Well	Depth to Bottom (ft)	Perforated Interval (ft)	Drill Date	Depth to Water (ft)
W15-6	361	178-408	1959	190
W15-8	202	not documented	1954/1966	197
W15-82	99	none documented	1954	n/a
W15-84	106	"	1954	n/a
W15-85	104	"	1954	n/a
W15-95	99	none documented	1959	n/a
W18-1				
W18-2				
W18-6	201	190-298	1964	n/a
W18-7	203	190-298	1964	n/a
W18-9	218	180-218	1968	211
W18-10	220	180-218	1968	n/d
W18-11	189	180-218	1969	n/a
W18-12	213	190-218	not doc.	n/a
W18-17	218	220-250	1981	201
W18-18	197	183-204	1981	198
W18-19	250	175-205	1982	n/a
W18-24	238	205-235	1987	214
W18-82	148	none documented	not doc.	n/a
W18-85	150	none documented	1969	n/a
W18-86	149	none documented	1969	n/a
W18-87	149	none documented	1969	n/a
W18-88	147	"	1969	n/a
W18-89	142	"	1969	n/a
W18-93	140	"	1972	n/a
W18-94	84	"	1972	n/a
W18-95	78	"	1972	n/a
W18-97	83	"	1972	n/a
W18-98	76	"	1972	n/a
W18-99	131	"	1972	n/a
W18-153	110	"	1976	n/a
W18-157	110	"	1976	n/a
W18-171	129	"	1977	n/a

4.1.1.1.2 Soil-Gas Sampling Points. Twenty-three soil gas sampling points have been installed in the vicinity of the three carbon tetrachloride disposal sites. The 22 sampling points around the 216-Z-18 Crib (Figure 4-3) consist of a small plastic tube rising above the surface and extending down 4 to 5 ft into the subsurface. Samples from 12 of these sampling points will be analyzed to provide data on the near-surface concentrations of carbon tetrachloride in the unsaturated zone. The points initially identified for sampling are: C-1, E-2, E-3, N-2, N-3, N-5, N-6, N-7, N-9, W-1, W-5. However, the specific 12 points sampled may be changed at the direction of the cognizant engineer.

The 23 sampling point (2W-15-06CP) was installed using the cone penetrometer near the 216-Z-9 Trench (Figure 4-3). It consists of a small plastic tube rising above the ground surface and extending 66 ft into the subsurface.

Additional soil-gas sampling points are scheduled to be installed as part of the Phase II Site Evaluation (Rohay 1991). As feasible, new points may be incorporated into the monitoring plan at the direction of the cognizant engineer.

The same measuring instruments used during well sampling and analysis (Section 4.1.1.1.1) are used for soil-gas sampling and analysis. These instruments extract a sample directly from the plastic tube that extends above the ground surface. At least two purge volumes will be extracted at the tubes before a sample is taken. Samples are analyzed for carbon tetrachloride and radon concentrations.

4.1.1.1.3 Ground Level Sampling. Ground level samples are taken at three locations in the vicinity of the three carbon tetrachloride disposal sites (Figure 4-4). Samples are measured using a TRI Odyssey 2001-05 (made by Transducer Research, Inc. of Naperville, Illinois) or equivalent instrument for the carbon tetrachloride and the RGM III or equivalent instrument for the radon. The TRI instrument is used for these analyses because it is more sensitive than the SIP to the low concentrations of carbon tetrachloride expected in ground level samples.

4.1.1.1.4 Fenceline Sampling. Samples are collected from four locations along the 200 West Area fenceline (Figure 4-5). The same instruments used in the ground level sampling and analysis are used for the fenceline sampling and analysis.

4.1.1.1.5 Analysis. All acquired data from the baseline monitoring of the unsaturated zone is recorded by the field technician in a field logbook or stored in the memory of the instrument. A printed copy of the sampling and analysis results from each day of monitoring is given to the project scientist and the cognizant engineer.

Calibration of the instruments is done by the sampling technician at the site just before the sampling takes place. The instruments are recalibrated any time readings on the instrument change without apparent reason. Calibration data are entered in the field logbook.

Figure 4-3. Locations of Existing Soil-Gas Sampling Points Sampled for Baseline Monitoring.

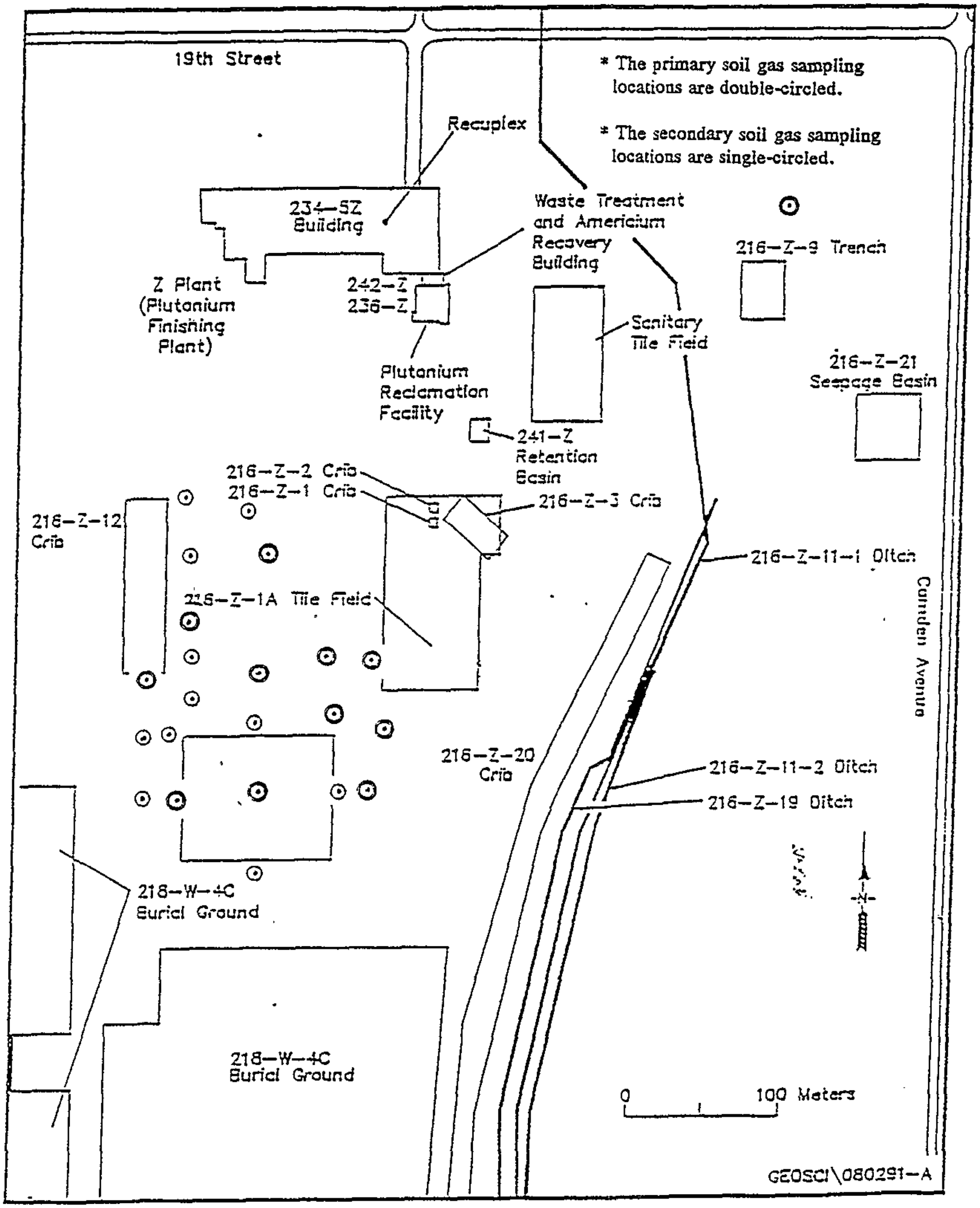


Figure 4-4. Ground Level Sampling Locations for Baseline Monitoring.

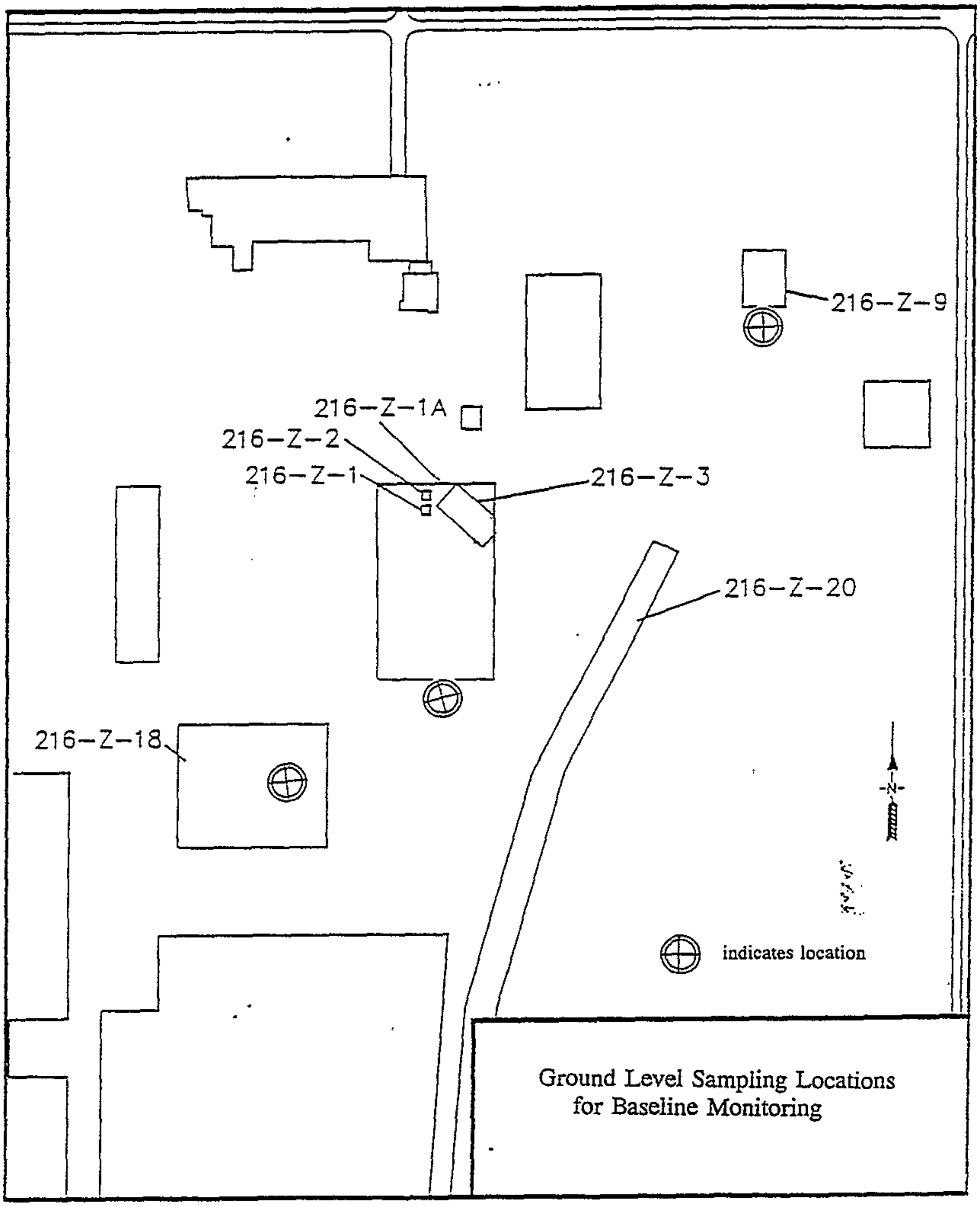


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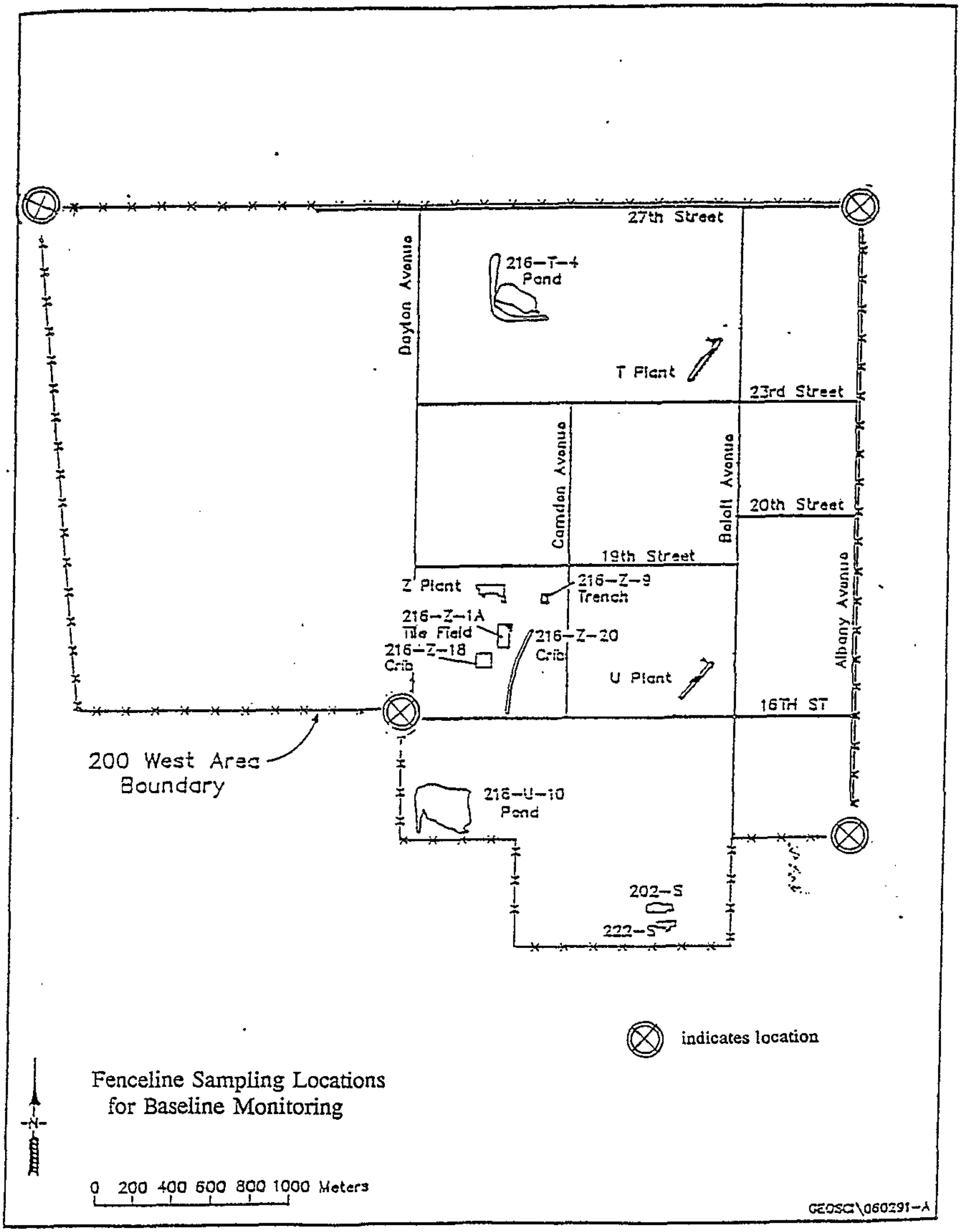
Figure 4-5. Fenceline Sampling Locations for Baseline Monitoring.



4.1.1.2 Groundwater. As part of Phase I and II site evaluations, groundwater was sampled and analyzed from existing monitoring wells in and around the three disposal sites and at other selected locations throughout the 200 West Area. In combination with other new and existing groundwater quality data, these data are used to assess and monitor the distribution and concentrations of carbon tetrachloride in the unconfined aquifer.

4.1.1.2.1 Groundwater Sampling. Groundwater monitoring samples will be collected from 17 existing wells in the 200 West Area. The wells monitor the upper 15 ft of the unconfined aquifer (Table 4-2 and Appendix H). Fifteen of these wells were sampled during Phase I between January and May 1991. All are scheduled to be resampled during Phase II by February 1992. Sampling during Phase II will occur at least once and at most quarterly. At the discretion of the project scientist or field team leader, wells may be added or subtracted from this list based on results of current sampling. In support of baseline monitoring, these wells will be sampled for VOC on a semiannual-to-annual basis.

Ongoing Hanford Site groundwater monitoring programs that sample 200 West Area wells include: (1) the Operational Groundwater Monitoring Network, (2) the RCRA program, (3) the 200 West Area Aggregate Area Management Study, (4) any groundwater monitoring required by liquid waste discharge permits, (5) the Pacific Northwest Laboratory (PNL) site-wide monitoring, and (6) the VOC-Arid ID. Baseline monitoring in the selected 17 wells is being coordi-nated with these other programs to avoid duplication of sampling efforts whenever possible.

The general sampling procedure involves purging three bore volumes and stabilizing temperature, conductivity, and pH prior to sample collection (PNL 1989). Sample vials used for volatile organic analysis were 40-mL amber glass vials with septum caps. Sample vials are carefully filled to eliminate air bubbles (i.e., "zero head space"). Field data and sampling conditions, including cross reference to sample chain of custody, are recorded on PNL groundwater sample field record sheets. Copies of all such records are maintained in the project files for this study as well as by PNL.

All groundwater samples are scheduled for volatile organic analysis. Although the target compounds for baseline monitoring are carbon tetrachloride and chloroform, several other volatile organics have been identified in soils of the 200 West Area and associated with past solvent extraction operations and testing. Thus, it was deemed important for site characterization to include the broad spectrum screen available by gas chromatography/mass spectrometry as well as analysis by standard gas chromatography methods more commonly available. Additional analyses will be conducted on samples from several wells as part of site characterization to further refine the understanding of contaminant distribution in the unconfined aquifer.

Groundwater data were identified as a need for baseline monitoring and site characterization since the inception of the ERA in 1990. Groundwater sampling and analysis plans were described in the Phase I and Phase II site evaluation workplans (Hagood and Rohay 1991; Rohay 1991). Inclusion of groundwater monitoring in this monitoring plan identifies those groundwater data needed to support the objectives of baseline monitoring.

Table 4-2. Construction Details for Existing Groundwater Wells Sampled for Baseline Monitoring.

Well	Depth to Bottom (ft)	Perforated Interval (ft)	Drill Date	Depth to Water (ft)	Sample Pump
W7-4	233	not documented	1987	211	Hydrostar
W7-5	228	"	1987	215	Hydrostar
W10-17	223	201-223	1990	207	Hydrostar
W10-18	222	200-221	1990	207	Hydrostar
W15-6*	361	178-408	1959	190	Submersible
W15-8	202	not documented	1954/1966	197	Hydrostar
W15-16	238	208-238	1987	215	Hydrostar
W15-22	222	199-220	1990	204	Hydrostar
W18-2	280	205-255	1958	214	Hydrostar
W18-9	218	182-212	1968	211	Submersible
W18-17	218	220-250	1981	201	Submersible
W18-20	238	220-249	1982	197	Submersible
W18-29	141	none documented	1991	126	none documented
6-38-70	291	255-305	1957	256	Submersible
6-39-79	234	195-245	1948	204	Submersible
6-43-88	191	142-192	1948	176	Submersible
6-49-79	279	225-265	1948	231	Submersible

4.1.1.2.2 Groundwater Analysis. All groundwater monitoring activities undertaken as part of the ERA site evaluation are conducted under full procedural controls required by the Westinghouse Hanford statement of work for Resource Conservation and Recovery Act (RCRA) of 1976 groundwater monitoring projects. These are the same procedures and the same organization used to collect samples in the past, thus contributing to the comparability between previous or existing data and the new data. Details of the laboratories, analytes, instrumentation, and quality control data and results for Phase I are reported by DOE (DOE-RL 1991, Appendix E).

4.1.2 Well Field Monitoring

Well field monitoring focuses on measurements of carbon tetrachloride vapor and radon concentrations, and vacuum pressures in the unsaturated zone. Sampling points are located at specific depth intervals within wells selected for use in the vapor extraction of carbon tetrachloride at the 216-Z-1A Tile Field. There is one primary extraction well (W18-150) and six primary monitoring wells in and around the tile field (Figure 4-3).

The extraction well is connected by a hose from the wellhead to the HEPA trailer. Flow measurements and control are made on the HEPA trailer manifold. A pressure indicating transmitter is located on the wellhead to provide information on the vacuum pressure developed at the well.

The extraction well has three perforated intervals (Table 4-3). A packer system provides the ability to extract from any one interval at a time. The packer system may be moved to change the extraction interval.

Table 4-3. Well Field Extraction and Monitoring Wells.

Well Number	Primary Use	Casing Diameter	Perforated Interval[a]
W18-87	Monitoring	6 inch	A 33-38 B 65-70 C 125-130
W18-150	Extraction	6 inch	A 62-67 B 82-87 C 111-116
W18-165	Monitoring	6 inch	122-127
W18-166	Monitoring	6 inch	124-129
W18-167	Monitoring	8 inch	114-119
W18-168	Monitoring	8 inch	118-123
W18-171	Monitoring	8 inch	A 20-25 B 57-77 C 115-130

[a]Depths given for the perforated intervals are in feet below the top of the casing.

The monitoring wells provide a means of observing the effect of the VES on the subsurface by monitoring vacuum pressure at the perforated intervals (Table 4-3). The monitoring wells are not connected to the VES test unit except by instrumentation cables tied in with the data acquisition system to provide information on vacuum pressure.

4.1.2.1 Soil Gas Measurements. Soil-gas concentrations will be measured at some of the extraction well and monitoring well intervals before full-scale extraction begins and after it ends to ensure sufficient extraction. These measurements are designed to characterize the horizontal and vertical profiles of carbon tetrachloride and radon vapors under and around the 216-Z-1A Tile Field. Caution must be taken to avoid "smearing" those profiles by inadvertently venting too much soil gas from each point. Therefore, the venting flowrate will be maintained at a low level (approximately 50 ft^3min) and the duration of the venting at each well shall be kept to the minimum time required to collect samples. The data sheet for these soil-gas measurements is shown in Figure 4-6. The parameters utilized during these tests may be varied by the cognizant engineer to optimize sample collection.

To ensure that a representative sample is collected, the VES piping and hoses must be purged, or flushed, prior to collecting the soil-gas samples. An initial flow rate of approximately 50 ft^3/min should be used to flush the system and the valves must be set to allow ambient air to flow in. Meters and gages will be monitored to assure complete flushing. The stabilized values on the meters and gages will be recorded prior to soil vapor collection.

After flushing the lines, the valves must be set to extract a soil-gas sample from the desired well and perforated interval. The pressure, flow rate, carbon tetrachloride concentrations, and radon concentrations will be continuously monitored by instrumentation. The instrument readings should stabilize after several minutes when the fresh air is replaced by the soil vapor. When the readings stabilize, they will be recorded. All process conditions of the VES will be documented. After conditions have stabilized and gas samples have been collected (if required by the cognizant engineer) the soil vapor measurements will be discontinued at that well and/or interval. Soil vapor measurements will be repeated at other wells, as determined by the cognizant engineer.

4.1.2.2 Vacuum Pressure Monitoring. Measurements of the vacuum pressures at the extraction well and at the monitoring wells during operations are recorded every 15 minutes or as specified by the cognizant engineer by the data acquisition system. The instrumentation in the well field is limited to vacuum pressure gages and transmitters. Instrumentation designations are:

W18-87	PIT2
W18-150	PI1, PT1, PIT1
W18-165	PIT3
W18-166	PIT4
W18-167	PIT5
W18-168	PIT6
W18-171	PIT7.

4.1.2.3 Sampling and Analysis. The data collected during the well field monitoring is gathered and transmitted to the data acquisition system for computer storage and use. These data include continuous measurements of carbon tetrachloride and radon concentrations taken from the vapor stream just before the GAC using a sintered crystal type carbon tetrachloride detector and an Eberline RGM III radon gas analyzer. The well field data are used primarily for trending analysis, studying the effect of varying carbon tetrachloride concentrations and flow rate and depth in the extraction well on the vacuum pressures in monitoring wells. This helps to indicate for a given carbon tetrachloride concentration flow rate and depth, at what distance from the extraction well and at what intensity soil vapor is pulled from the soil. Then the flow rate and depth can be selected which will give the highest mass flux of carbon tetrachloride out of the soil.

Observer________________________ Date______________

Well Number	Perf. Interval (feet)	Purge Flowrate (cfm)	Purge Time (min)	Purge Volume (ft3)	Purge Vacc. (" wg)	CT1 (ppm)	RTC1	Gas Sample	Remarks

Figure 4-6. Data Sheet for Well Field Soil-Gas Measurements.

4.1.2.4 Trending Analysis. All instrumentation readings from the well field are transmitted to the data acquisition system for computer storage. The data acquisition system is capable of receiving data at all times during operation and of transmitting either the real time data as they are received or historical data. The existing data can be manipulated while the data acquisition system receives additional data from the operation. The data acquisition system is a very vital part of the trending analysis conducted at the well field. The data gathered indicate carbon tetrachloride flow behavior, whether or not the equipment and instruments are functioning correctly, and what extraction procedures can withdraw the most carbon tetrachloride at the highest flow rate.

The first extraction test interval is W18-150A, 62 to 67 feet below the top of the casing (Table 4-3). A flow rate of 50 ft^3/min will be applied initially during extraction. At this time, all instruments will be transmitting data to the data acquisition system. These data will include parameters such as the pressure from all monitoring wells, the carbon tetrachloride concentration extracted, and the flow rate. During the initial stages of extraction, data will be logged frequently (e.g., every 2 min.). As the extraction continues, data will be logged less frequently (e.g., every 5 to 10 min.). The frequency of data collection is subject to the discretion of the cognizant engineer.

While the data are logged into the data acquisition system, it may be manipulated into graphs and/or spreadsheets. The concentration of carbon tetrachloride may be plotted on a graph in relation to time at the constant flow rate (50 ft^3/min initially). In the meantime, the vacuum pressures in the outlying monitoring wells will be logged into the data acquisition system and can also be observed in graphical form. At the beginning of the extraction, it is expected that the carbon tetrachloride concentration plots will show an increase with time. As the extraction continues, this increase in concentration is expected to reach a plateau, after which the concentration will remain relatively constant. Once the concentration is stabilized, the extraction flow rate will be increased to 100 ft^3/min. Data will continue to be observed in the same manner, including the vacuum pressure in the monitoring wells. The carbon tetrachloride concentration may again increase and then plateau. At the discretion of the cognizant engineer, the flow will then be increased. This process of flow increase will continue until the concentration drops off significantly or a maximum flow of 500 ft^3/min is reached without a large drop off in the concentration.

At this time, the system will be shut down and extraction from W18-150B will be set up. This testing will continue until all three extraction intervals in W18-150 have been done. Similar extraction tests at the monitoring wells may be performed at the discretion of the cognizant engineer. During system shutdown, the instruments can be checked and the soil vapor may be allowed to recharge for a day or so. Soil-gas concentrations may also be measured at the next extraction point before beginning the extraction tests.

The highest mass flux of carbon tetrachloride extracted from each extraction point will be calculated based on the highest concentration at the largest flow rate. These will be used to rank all the extraction points based on this highest mass flux. The vacuum pressure data gathered from the wells will be used in the ranking of the extraction points. The extraction points which caused the highest vacuum pressure in the outlying areas will contribute to a higher ranking. The cognizant engineer will implement weighting factors on the ranking criteria.

After the extraction points have been ranked, the highest ranked point will be extracted at it's highest recorded flow. The flow rate will be adjusted to observe the local maximum flux on the graph of carbon tetrachloride concentration versus time.

After allowing time for the soil vapor to recharge in the subsurface, the second ranked point will be added to the extraction system and these two points will be extracted simultaneously. The data will be observed closely and the flows will be adjusted up and down to find the local maximum flux for the graph of concentration versus time created with the two highest ranked points being extracted together.

Once the local maximum flux is found for the two highest ranked points, the soil vapor will be allowed to recharge in the subsurface. Third highest ranked point will be added to the system. A local maximum flux will be found by performing flow adjustments and observing the graphical data with the top three extraction points hooked up. Similarly, the fourth highest ranged point will then be added to the system and the local maximum flux will be found with all four hooked up.

After this extraction testing has been completed, one extraction point or some combination of extraction points should be identifiable as providing the highest mass flux of carbon tetrachloride. This should represent the most effective and thorough operation for extracting carbon tetrachloride from the subsurface with the present well field arrangement.

4.2 TEST UNIT MONITORING

A combination of continuous electronic monitoring and manual data recording will be performed while the system is operating. Sampling will be conducted on the VES test unit for analysis of chemical and radiological constituents and for certain physical parameters. The test unit consists of the processing system (containing the HEPA trailer and the blower trailer) and the treatment system. The description of the system, sampling points and sampling instrumentation is found in Chapter 2. Sampling locations, parameters, and sampling frequency are shown in Appendix B (Table B-1).

4.2.1 Chemical and Radiological Parameters

The principal contaminants of concern found within the subsurface consist of VOC (principally carbon tetrachloride, chloroform, methylene chloride); butyl alcohol, (a degradation product of TBP and DBBP), and methane. The potential presence of methane is also a safety concern due to its potential explosivity.

Particulate radionuclides including plutonium and americium, which would be transported on soil particles, may be entrained into the vented gas stream during VES operations. However, this is not expected, but precautions shall be taken to monitor the system for radiological contamination.

Naturally occurring radon in the unsaturated soils may also be a concern as radon will be extracted from the unsaturated soils, sorbed to GACs and vented to the atmosphere. Radon will be continuously monitored at the test unit treatment system.

Other radiological components (tritium, iodine-129, technetium-99, and carbon-14) are not of concern in the unsaturated zone soil because: (1) they are below detection limits in groundwater at the site (Hanford Groundwater Data Base); and/or (2) they were not disposed of into the tile field; and (3) they were not detected during the pilot test.

4.2.1.1 Sampling. Sampling of test unit vapor stream for analysis of chemical and radiological constituents is conducted manually and electronically.

4.2.1.1.1 Vapor Stream.

- The vapor stream at the HEPA trailer will be sampled using stainless steel sample extraction tubes connected via sample ports to all lines of the manifold. The tubes terminate as valves inside a sampling cabinet. Inside the cabinet, glass bulb samples can be taken from each line by connected the desired sample line to a small vacuum pump. These samples will be taken twice daily during operations (or as determined by the cognizant engineer). The samples will be analyzed by a laboratory outside the operation area. The results will be used to verify the on-line continuous carbon tetrachloride and radon sampling data, to measure the lower explosive limit, and to measure other chemical and radiological constituents in the soil vapor.

- The vapor stream will be directly measured for alpha and betga radiation by two process CAM. These CAM are linked via tubes connected to sample ports between the two HEPA filter banks. These CAM are equipped with individual audiovisual alarms and send continuous information to the data acquisition system, which has an alarm capable of shutting down the VES if necessary.

- A carbon tetrachloride meter and a radon meter are in place before, between, and after the GAC canisters. These are sintered crystal type carbon tetrachloride detectors and Eberline RGM III radon gas analyzers capable of continuous monitoring. The first meters measure total carbon tetrachloride and radon concentrations exiting the well field. The meters between the GAC canisters indicate the passthroughs of the primary canister. The meters downstream of the secondary canister indicate the stack emissions. The radon meter may be monitored in the manual mode without being connected to the process control system.

- The vapor stream will be sampled for analysis of butyl alcohol through the HEPA trailer sample cabinet. Glass sampling tubes containing GAC will be attached to the desired sample lines twice daily during operations or as determined by the cognizant engineer.

4.2.1.1.2 Liquid

- The water knockout tank is used if high levels of moisture are found in the soil vapor. The tank and it's piping have temperature gages, temperature transmitters, pressure gages, and sampling ports. These sampling ports will be used to sample the liquid for tritium and carbon tetrachloride prior to disposal.

4.2.1.1.3 Carbon

- The GAC canisters will be monitored each shift by an Health Physics Technician for gamma radiation for safety precautions.

- Carbon from the first two canisters used in the VES process will be sampled for radionuclide analysis before and after the canisters are filled. Results of the analyses will be used to seek approval for offsite shipment of the GAC canisters.

4.2.1.2 Analysis. Manually sampled vapor and liquid will be analyzed by an independent laboratory. This independent laboratory will analyze the glass bulb samples taken from the sample cabinet for carbon tetrachloride concentrations, radon, butyl alcohol, and other VOC, and will check the lower explosive limit. This laboratory will also analyhze the water samples from the water knockout tank to tritium and carbon tetrachloride. The laboratory will use approved EPA methods or standard laboratory practices for analysis of all constituents.

Carbon filter samples will be analyzed for VOC and tritium by the laboratory before the GAC canistes are shipped offsite for regeneration.

4.2.2 Physical Parameters

All physical parameters will be measured and transmitted to the process control system computer for processing and storage. The physical parameters are as follows:

- Barometric pressure - the barometric pressure will be measured in atmospheres in the well field continuously throughout the duration of the VES operation. Recordings will be taken by the computer every hour during operation.

- Air temperature - the ambient air temperature will be measured in °C with a digital thermometer or temperature transducer. The frequency of the temperature recordings will be hourlyh.

- Top hole pressure - the pressure at the top of the extraction wells will be recorded in conjunction with the downhole pressures. A transmitter shall be used to transmit the measurement to the process control system. The measurements will be made hourly.

- Volumetric flow rate - the flow rate at the extraction well will be measured by a flow meter in the HEPA trailer manifold. The meter should be able to read up to 500 ft^3/min and transmit to the tenths decimal place. The flow measurements are used to monitor the extraction operation.

- Relative humidity - the relative humidity of the soil vapor will be measured hourly just before the water knockout tank. This reading will indicate the need to reduce moisture in the soil vapor stream.

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5.0 REPORTING

Quarterly status reports will be completed that summarize the current status of VES operations, VES operational history for the preceding 3 mo, VES design changes, identification and cumulative extraction amounts of VOC, analytical results, site characterization information, and any pertinent activities associated with the VOC-Arid ID. An annual report will be submitted that summarizes these same activities over the preceding year. These documents will be submitted to DOE Richland Field Office (RL), EPA, and Ecology.

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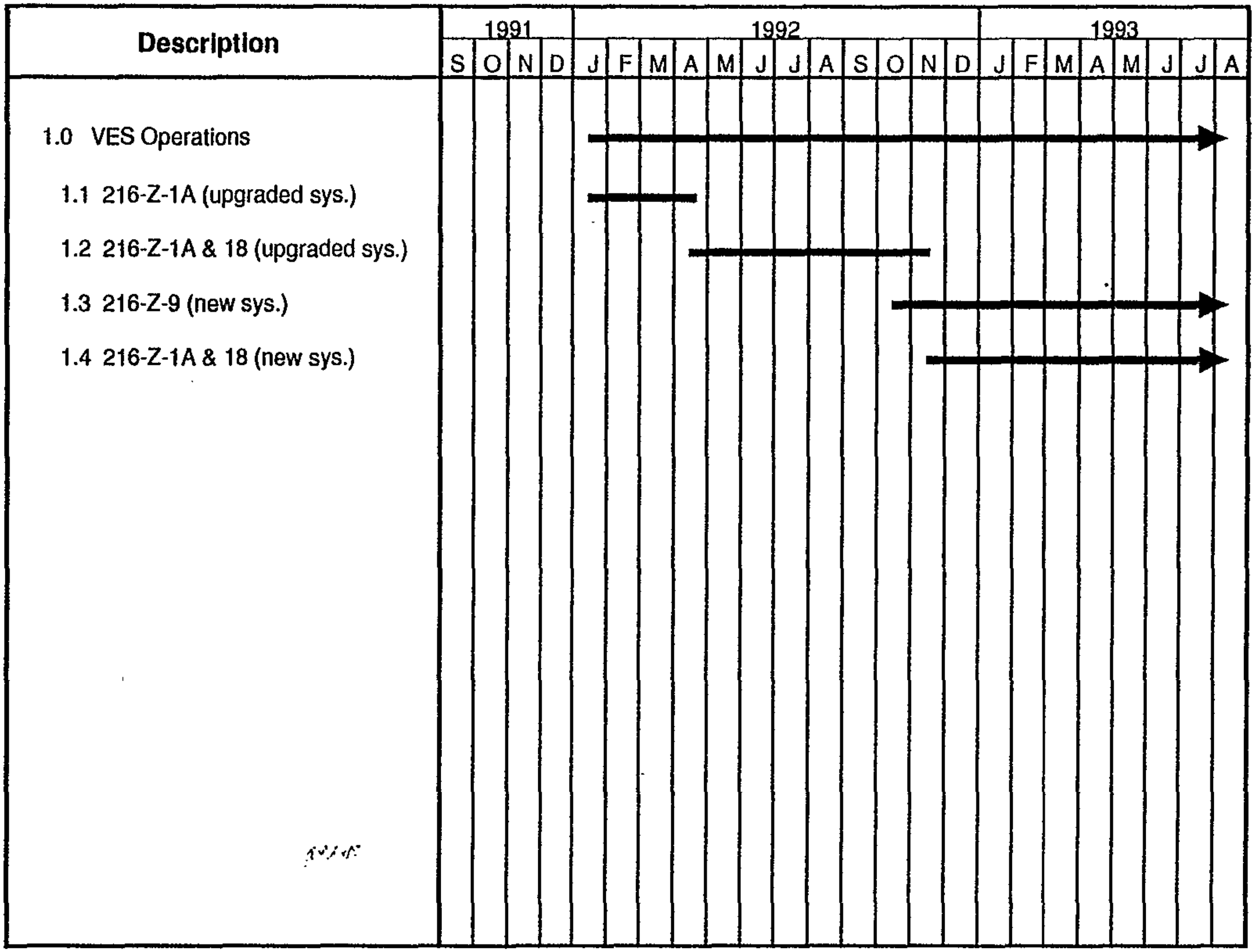
6.0 SCHEDULE

The VES will begin extraction of carbon tetrachloride and associated VOC at the 216-Z-1A Tile Field in January 1992 (Figure 6-1). Further expansion of the 216-Z-1A Tile Field well field will occur throughout its operational period.

During this same time period, the well field for the 216-Z-18 Crib will be prepared for soil vapor extraction testing. The extraction testing will be conducted using the system located at the 216-Z-1A Tile Field. The testing will occur during the spring of 1992.

Based on test results, the VES will extract from both the 216-Z-1A Tile Field and the 216-Z-18 Crib alternately or simultaneously. Extraction will continue as long as reasonably achievable based on results and direction/concurrence with RL and EPA (the lead regulatory agency).

Soil vapor extraction at the 216-Z-9 Crib will be conducted with another VES unit (not discussed in this document) in the fall of 1992.



VES OPS

Figure 6-1. Schedule for VES Operations.

7.0 REFERENCES

DOE-RL, 1991, Exedited Response Action Proposal (EE/CA & EA) for 200 West Area Carbon Tetrachloride Plume, DOE/RL-91-32, Draft B, U.S. Department of Energy, Richland Field Office, Richland, Washington.

Hagood, M. C., and V. J. Rohay, 1991, 200 West Area Carbon Tetrachloride Expedited Response Action Project Plan, WHC-SD-EN-AP-046, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

PNL, 1989, Procedures for Groundwater Investigations, PNL-MA-567, Pacific Northwest Laboratory, Richland, Washington.

Rohay, V. J., 1991, 200 West Area Carbon Tetrachloride Expedited Response Action Phase II Site Evaluation Work Plan, WHC-SD-EN-AP-059, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX A

DESIGN SPECIFICATIONS

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A.1 TEST UNIT

A.1.1 General System Requirements

The vapor extraction system (VES) flow path and instrumentation is shown in Figure A-1. Table A-1 for the system instrumentation follows the figure.

The general system requirements are based on design limitations of the carbon tetrachloride VES equipment. These limitations are:

- 500 actual ft^3/min total flow rate.
- Maximum 10 inches of mercury vacuum.
- Extract carbon tetrachloride from three or more wells at one time, depending on the site characteristics.
- Capable of sampling the soil vapor extracted.
- High efficiency particulate are (HEPA) filters filter the soil vapor stream to remove potential radioactive particulates.
- Capable of monitoring that the operations meets all environmental controls.
- Carbon tetrachloride effluent concentration is 25 ppm maximum.
- Operable in an external ambient temperature range of -10°F to 110°F.
- Able to withstand winds up to 100 mph.
- Capable of operating in a 10-yr, 24-hr rainfall event.
- Operable up to 365 solar days per year.y be set at 5 ppm vol.

A.1.2 Regulatory Requirements

Regulations considered potentially applicable are listed in Table A-2. Several primary DOE orders, Westinghoue Hanford procedures, American National Standards Institute (ANSI), and U.S. Nuclear Regulatory Commission (NRC) regulations that may apply are listed in Table A-3.

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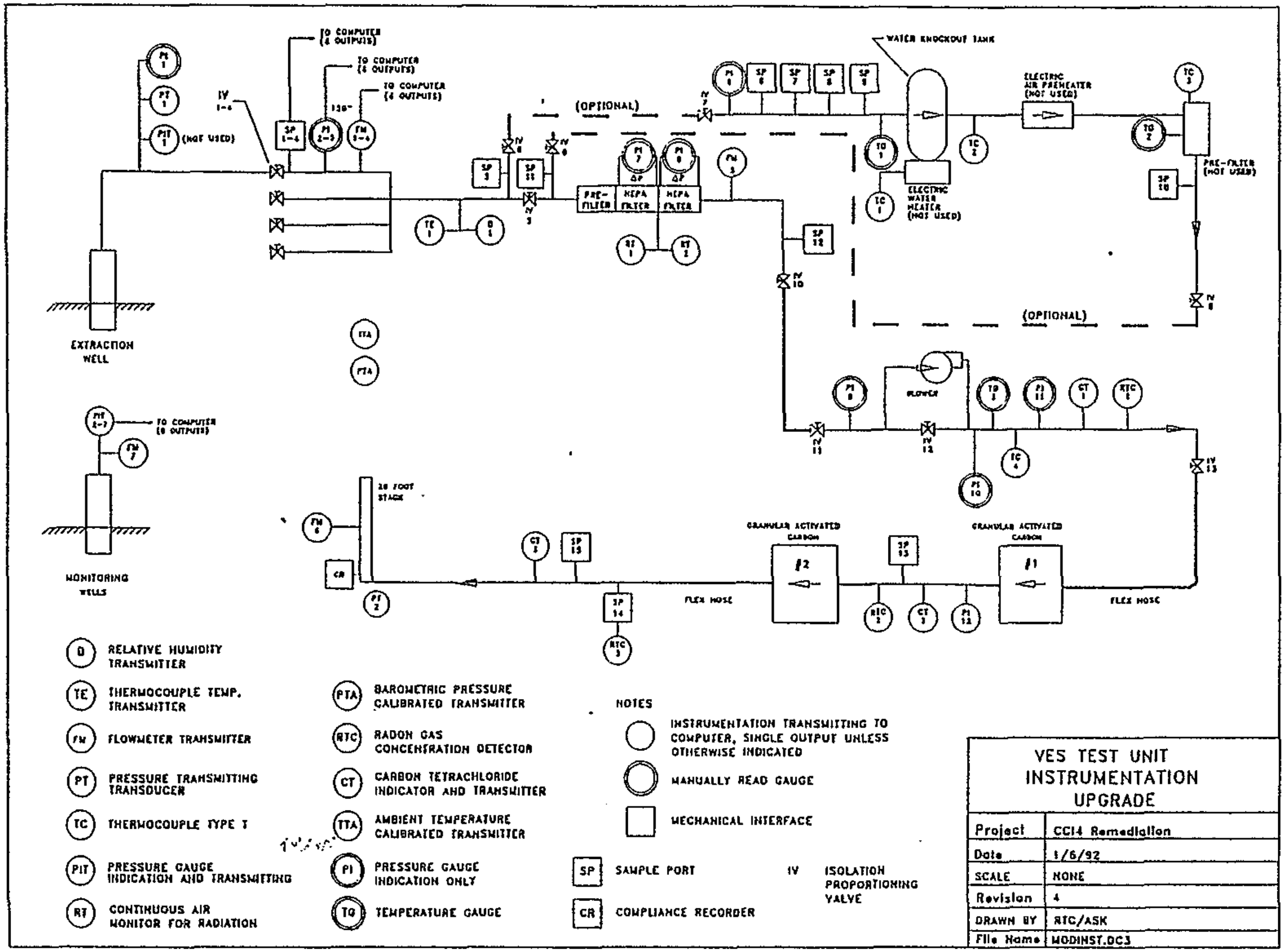

Figure A-1. VES Test Unit Instrumentation.

Table A-1. System Instrumentation Notes.

SP	Sample ports
IV	Isolation proportioning valve - manually adjusted
PI	Pressure gage
PIT	Vacuum gage and calibrated transmitter
PT	Pressure transmitter
FM	Flow meter and calibrated transmitter
TIT	Temperature gage calibrated transmitter
TE	Thermocouple
D	Relative humidity meter
RT	Continuous air monitor (CAM) for radiation
CT	Carbon tetrachloride concentration calibrated meter
CR	Record sample
TG	Temperature gage
TTA	Ambient temperature calibrated transmitter
PTA	Barometric pressure calibrated transmitter.
RTC	Radon gas concentration calibrated meter.
TG	Temperature gage

Table A-2. Summary of Potentially Applicable Environmental Regulations.

Regulation	Applicable	Comments
WAC 246-247 (formerly WAC 402-80) (RAEP)	Yes	If radionuclides are extracted during the test, pre-operational notification to DOH is required.
40 CFR 61 (NESHAPs)	No	Applicable only if extracted radionuclides result in a dose of 0.1 mrem or greater, using 40 CFR 61, Appendix D methodology.
WAC 173-400 (PSD)	No	Unless emitting large quantities of carbon tetrachloride (more than 40 tons/yr).
40 CFR 264-265, Subpart AA and BB (RCRA Organic Air)	Possible	CERCLA actions of this type are specifically excluded from permitting, but compliance may be required.
40 CFR 264, Subpart O Incinerators	Yes	99.99% conversion efficiency of carbon tetrachloride in thermal units <4 lb/h HCl in emissions.
State TAP Regulations WAC 173-460	Yes	ASIL for carbon tetrachloride is 0.067 $\mu g/m^3$ (annual average) ASIL for HCl is 23.3 $\mu g/m^3$ (24-h average)
CERCLA Reportable Quantities (40 CFR 302)	Yes	Reportable quantities are over 4.5 kg carbon tetrachloride/day/disposal site and 2,270 kg HCl/day/disposal site.
WAC 173-160	Yes	Well construction standards.

ASIL = Acceptable Source Impact Level
CCl_4 = Carbon Tetrachloride
DOH = Washington Department of Health.
HCl = Hydrochloric Acid
NESHAPs = National Emissions Standards for Hazardous Air Pollutants
PSD = Prevention of Significant Deterioration
RAEP = Radiological Airborne Emission Program
TAP = Toxic Air Pollutants
T-BACT = Best Available Control Technology for Toxics

Table A-3. Regulations and Procedures That May be Applicable.

Regulations and Procedures	Title
ANSI N13.6	Practice for Occupational Radiation Exposure Records Systems
ANSI N42.18-1980	Specification and Performance of Onsite Instrumentation for Continuously Monitoring Radioactivity in Effluents
ANSI N323-1978	Radiation Protection Instrumentation Testing and Calibration
DOE Memorandum	W.A. Vaughn, August 5, 1986, Radiation Standards for Protection of the Public in the Vicinity of DOE Facilities
DOE Order 5400.1	Guide Environmental Protection Program
DOE Order 5400.5	Radiation Protection of the Public and the Environment
Draft DOE Order 5400.xx	Radiation Protection of the Public and Environment
Draft DOE Order 5400.xy	Radiological Effluent Monitoring and Environmental Surveillance
DOE Order 5480.10	Contractor Industrial Hygiene Program
DOE Order 5480.4	Environmental Protection, Safety, and Health Protection Standards
DOE Order 5480.11	Radiation Protection for Occupational Workers
DOE Order 5484.1	Environmental Protection, Safety, and Health Protection Information Reporting Requirements
DOE Order 5820.2A	Radioactive Waste Management
DOE Order 6430.1	General Design Criteria
DOE/EP - 0096	A Guide for Effluent Radiological Measurements at DOE Installations
DOE-RL, March 1987	Plan and Schedule to Discontinue Disposal of Contaminated Liquids into the Soil Column at the Hanford Site
DOE-RL	Implementation Plan for Hanford Site Compliance to DOE Order 5820.2, Radioactive Waste Management, August 1986
DOE-RL-89-18	Environmental Protection Implementation Plan
DOE-RL Order 5480.11A	Requirements for Radiation Protection
DOE-RL Order 5484.1	Effluent and Environmental Monitoring Program Requirements, Chapter III
NRC	Title 10, Code of Federal Regulations, Part 20, Standards for Protection Against Radiation
WHC-CM-1-1 (WHC 1987b)	Management Policies
WHC-CM-1-3 (WHC 1988f)	Management Requirements and Procedures Manual
WHC-CM-2-1 (WHC 1988i)	Procurement Manual
WHC-CM-2-14 (WHC 1988d)	Hazardous Material Packaging and Shipping
WHC-CM-4-1 (WHC 1988l)	WHC Emergency Plan
WHC-CM-4-3 (WHC 1987a)	Industrial Safety Manual, Volumes 1 and 4
WHC-CM-4-11 (WHC 1988a)	ALARA Program
WHC-CM-5-10 (WHC 1988j)	Radiation Protection
WHC-CM-5-16 (WHC 1988e)	Hazardous Waste Management
WHC-CM-7-4 (WHC 1988g)	Operational Environmental Monitoring
WHC-CM-7-5 (WHC 1988c)	Environmental Compliance
WHC-CM-7-6 (WHC 1991a)	Environmental Compliance Verification Manual
WHC-CM-8-6 (WHC 1988k)	Site Support
WHC-CM-8-7 (WHC 1988h)	Operations Support Services
WHC-EP-0137 (WHC 1988b)	Best Available Technology (BAT) Guidance document for the Hanford Site

A.2 WELL FIELD

A.2.1 Well Configuration

Initial extraction wells and observation wells are listed in Tables A-4 and A-5.

Table A-4. Phase I Well Field Configuration at the 216-Z-1A Tile Field.

Well	Type	Casing Diameter (in.)	No. of Pipes	Perforated Interval (ft below top of casing)	Open Area in Perforated Interval (%)
W18-150	Extraction	6	3	62 to 67 82 to 87 111 to 116	4 4 4
W18-87	Monitoring	6	1	33 to 38 65 to 70 125 to 130	4 4 4
W18-165	Monitoring	6	0	122 to 127	4
W18-166	Monitoring	6	0	124 to 129	4
W18-167	Monitoring	8	0	114 to 119	3
W18-168	Monitoring	8	0	118 to 123	3
W18-171	Monitoring	8	1	20 to 25 57 to 77 115 to 130	3 3 3

A.2.2 Well Construction

The basic well construction is shown in Figures A-2 and A-3. Well construction minimizes air flow short circuiting both in the well casing and along the annular space outside the casing. The well seal materials are washed pebble and sand, a bentonite polymer mix, and Schedule 40 polyvinyl chloride (PVC) pipe using glued fittings.

The downhole pipe is 2 inches in diameter. The pipe in the area next to the perforated interval uses 20 slot screen with a plug at the end of the section. Some of the initial primary extraction wells and the monitoring wells have similar construction. This allows the wells to be used for extraction.

For Phase I operations, the extraction well and two of the monitoring wells have packer systems rather than filled-well construction.

Table A-5. Phase II Well Field Configuration at the 216-Z-1A Tile Field.

Well	Type	Casing Diameter (in.)	No. of Pipes	Perforated Interval (ft below top of casing)	Open Area in Perforated Interval (%)
W18-150	Extraction	6	3	62 to 67 82 to 87 111 to 116	3 3 3
W18-158	Extraction	6	3	75 to 80 89 to 94 119 to 124	3 3 3
W18-159	Extraction	6	2	70 to 80 112 to 119	3 3
W18-163	Extraction	8	3	67 to 77 90 to 97 112 to 117	3 3 3
W18-175	Extraction	6	3	68 to 75 87 to 94 115 to 120	4 4 4
W18-87	Monitoring	6	1	33 to 38 65 to 70 125 to 130	3 3 3
W18-165	Monitoring	6	0	122 to 127	4
W18-166	Monitoring	6	0	124 to 129	4
W18-167	Monitoring	8	0	114 to 119	3
W18-168	Monitoring	8	0	118 to 123	3
W18-171	Monitoring	8	1	20 to 25 57 to 77 115to 130	3 3 3

A.2.3 Well Perforations

The perforated intervals of each of the wells are given in Table A-2. The perforation size is 2.8 in^2. There are typically 20 perforations per linear foot of casing. This provides an effective open area over the perforated interval of about 4% in the perforated interval of the 6-inch casing and 3% in an 8-inch casing. Figure A-2 shows a perforated well section.

Figure A-2. Typical Extraction Well Construction.

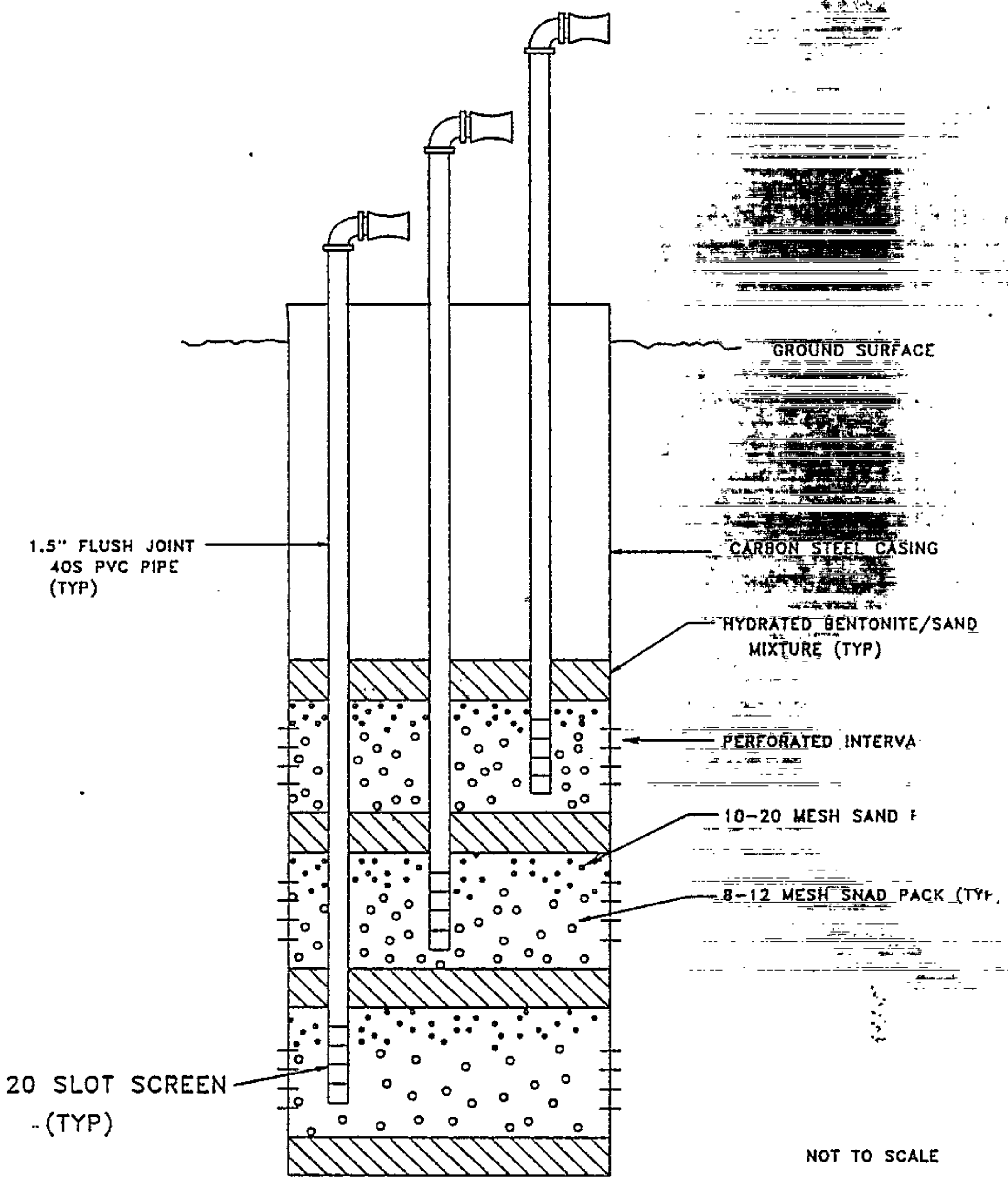

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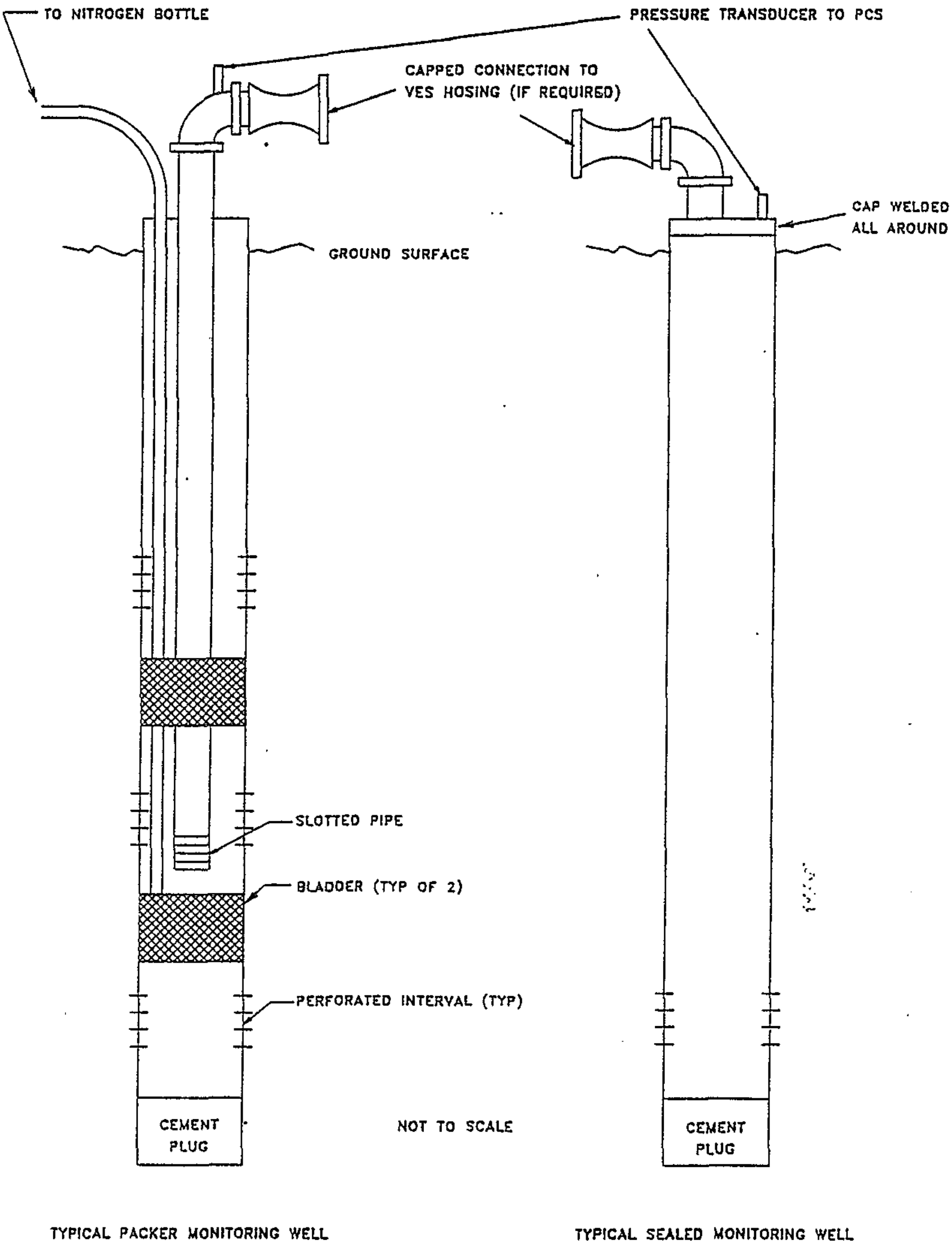
Figure A-3. Typical Monitoring Well Construction.



A.2.4 Well Connections

Figures A-4 and A-5 show the 6- and 8-in. extraction well caps. Figures A-6 and A-7 show the monitoring well caps. Figures A-8, A-9, and A-4 show the wellhead manifold. The materials list for the wellhead manifold is given below. During the Phase I operations, a wellhead manifold will not be used.

Materials List - Wellhead Manifold.

PIPE

- 4-inch dia. 40S C.S.
- 2-inch dia. 40S C.S.

FITTINGS

1	8-inch Tee
4	8- by 4-inch Tee
4	2-inch Union
4	2-inch Tee
12	2-inch Ball Valve
4	2-inch Camlock

SUPPORT

2	Scaffold End Frame - Sky Tower Steel Section Type E, No. 8187T17, or equivalent
4	Cross Braces - Sky Tower 7 ft Brace, No. 8187T24, or equivalent
4	Base Plate - Sky Tower Base Plate, No. ____, or equivalen
4	Adjustment Screw - Sky Tower Adjustment Screw, No. ____, or equivalent
8	U-Bolts (field fit for size) 1-inch Unistrut

9 2 1 2 1 9 3 0 6 3 4

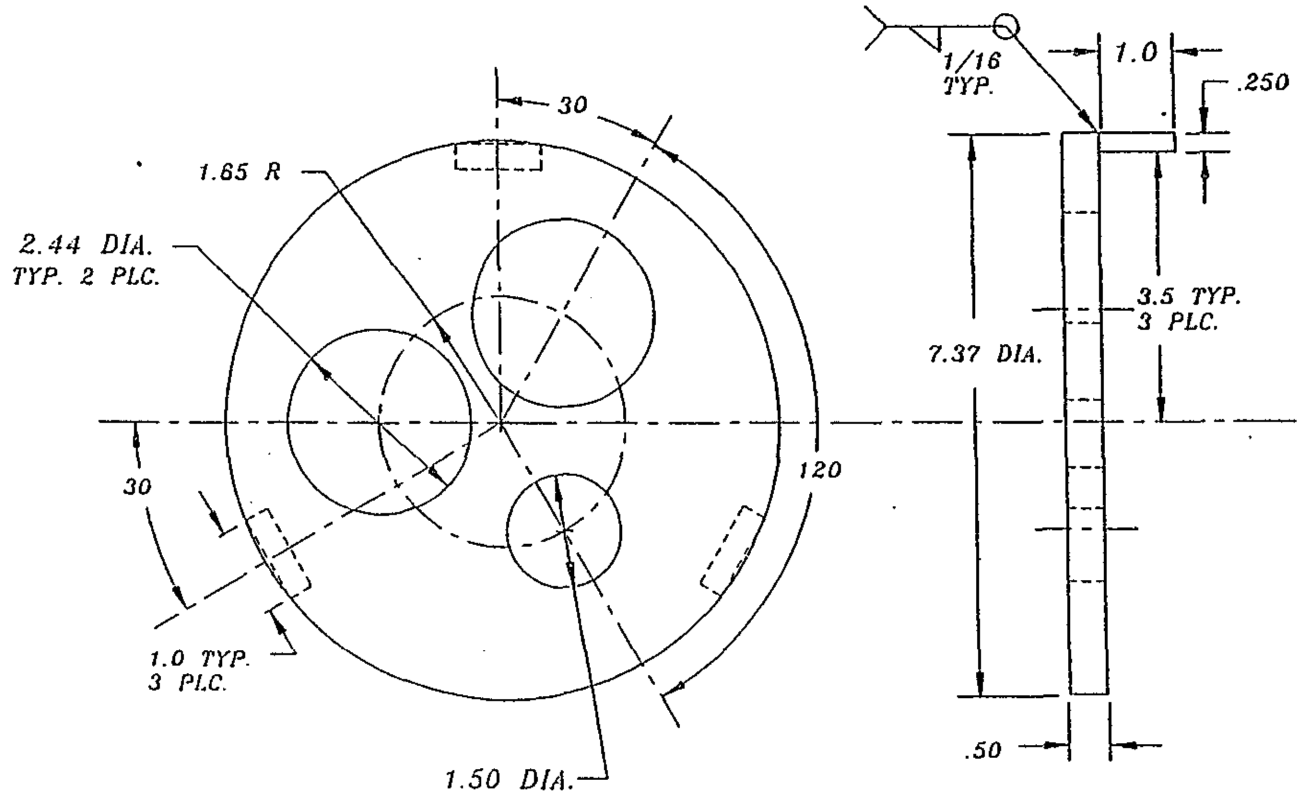


Figure A-4. 6-Inch Extraction Well Cap.

Figure A-5. 8-Inch Extraction Well Cap.

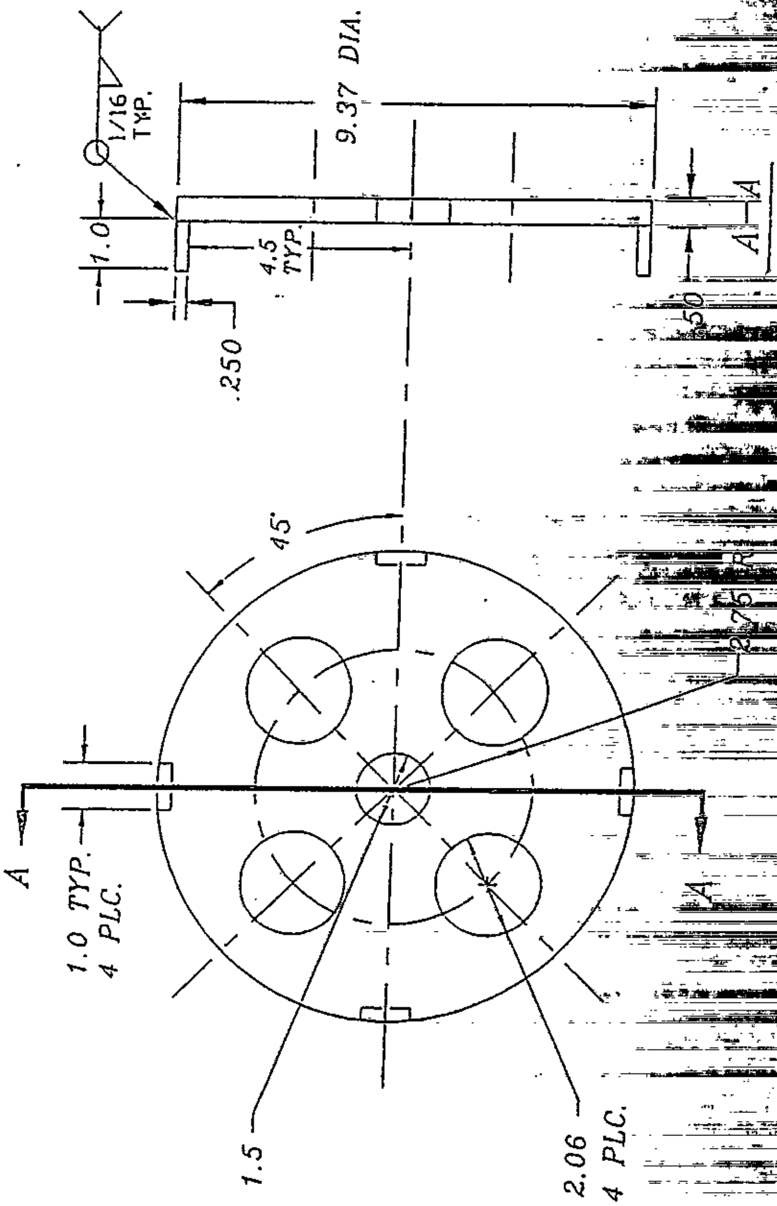


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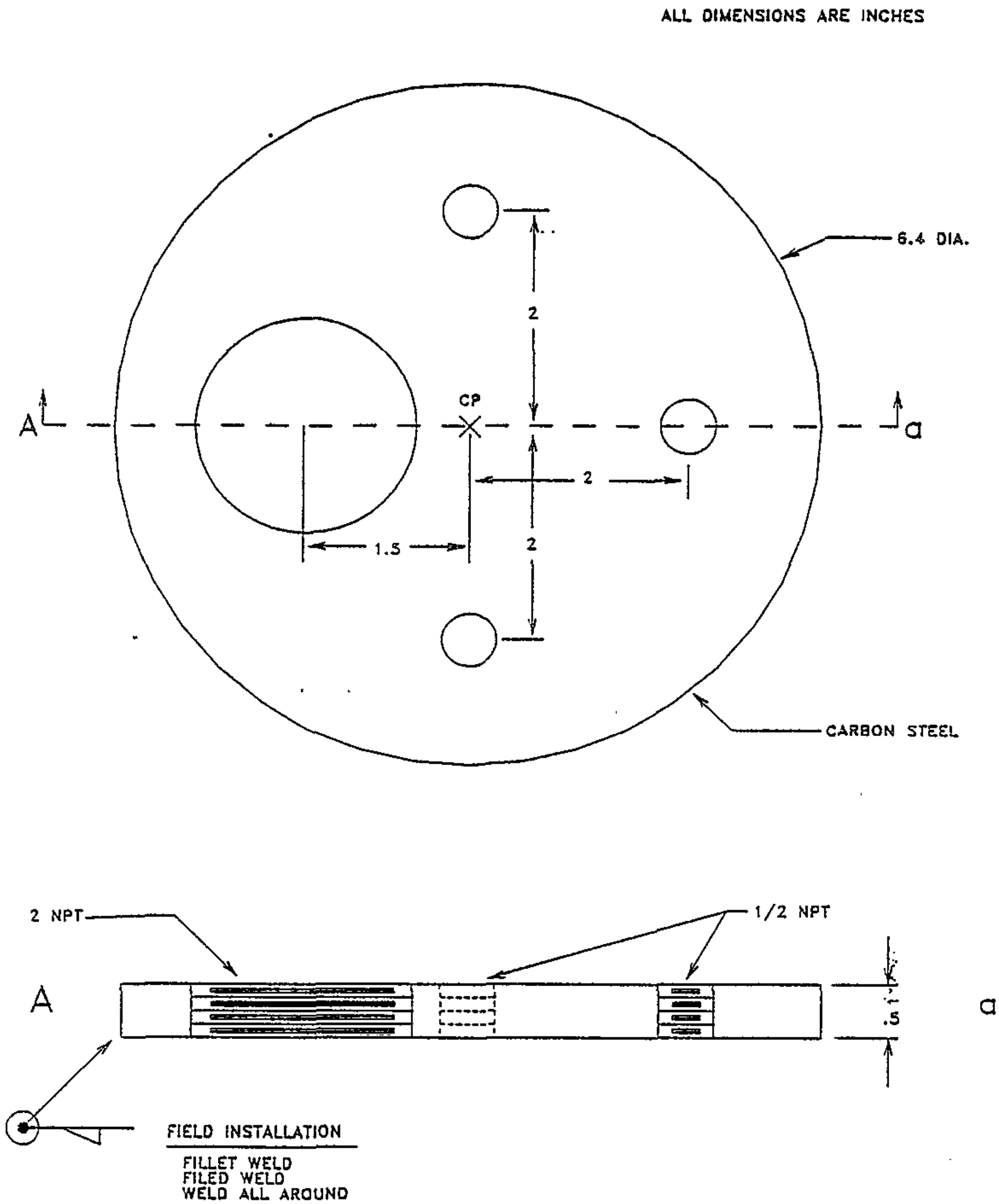
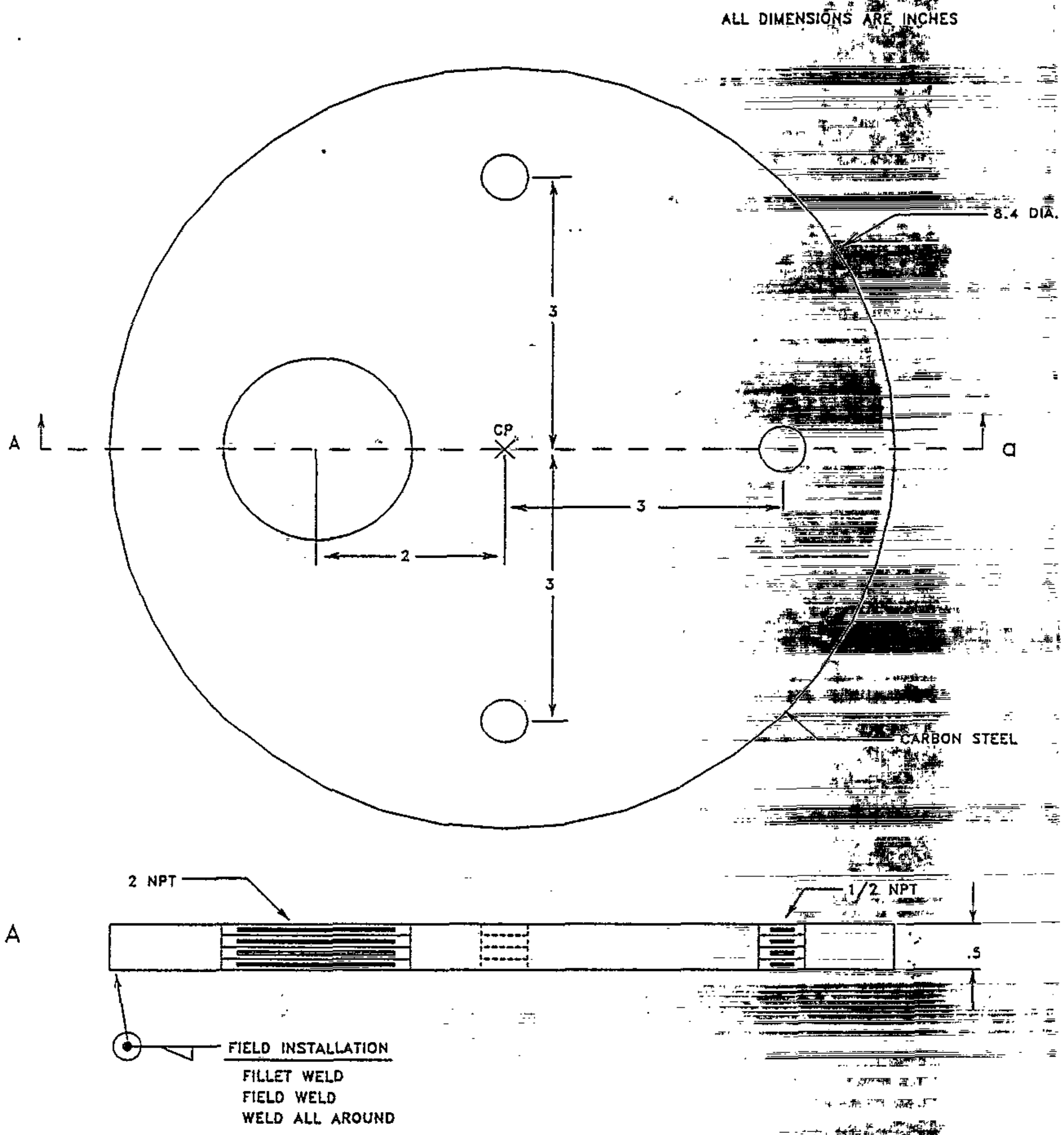
Figure A-6. 6-Inch Monitoring Cap.



6" MONITORING WELL CAP

9 2 1 2 9 3 1 6 3 6

Figure A-7. 8-Inch Monitoring Cap.



8" MONITORING WELL CAP

9212490637

9 2 1 2 9 3 7 6 3 8

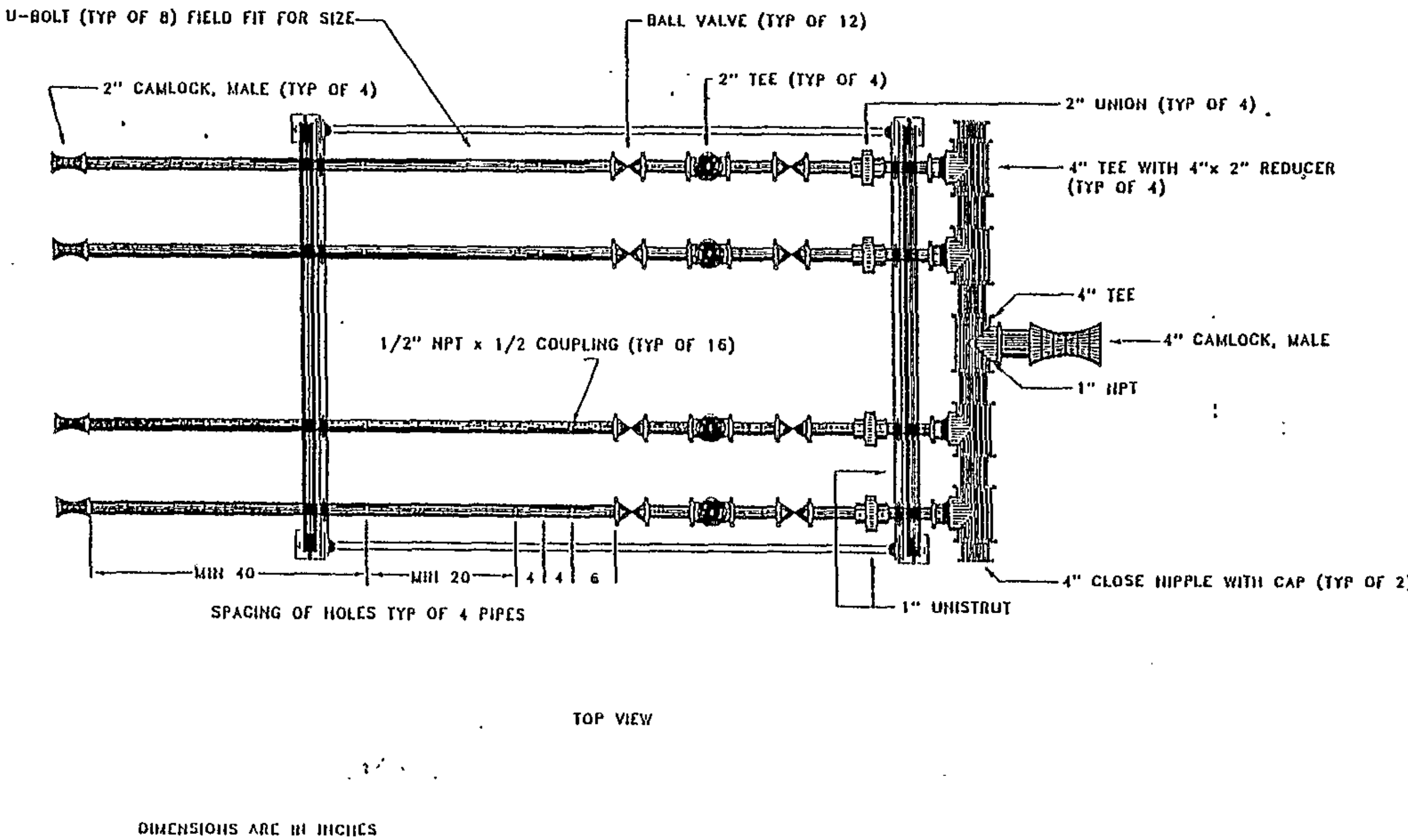
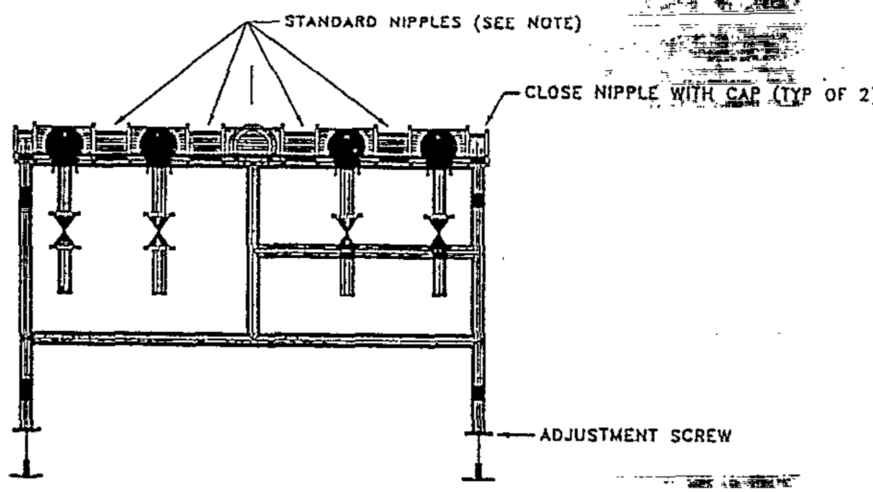


Figure A-8. Wellhead Manifold - Top View.

Figure A-9. Wellhead Manifold - Side View.

SPACING OF PIPES IS FIELD-FITTED USING STANDARD NIPPLE LENGTHS (APPROX. 6")



SIDE VIEW

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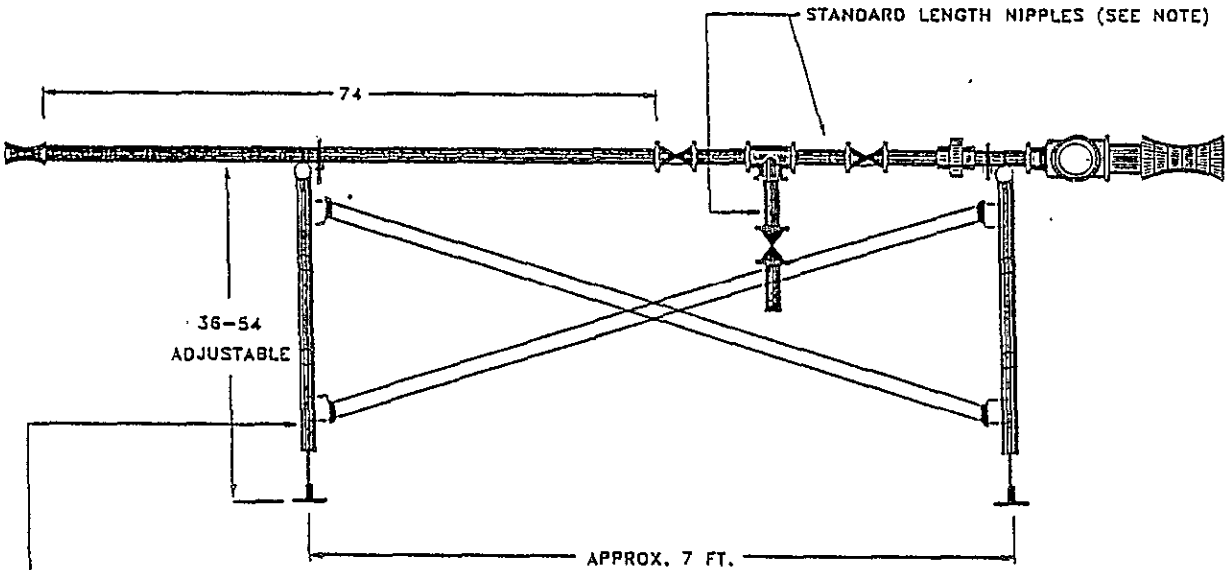
Figure A-10. Wellhead Manifold - Front View.



SCAFFOLDING - END FRAME (3 FT HEIGHT, 7 FT LENGTH) MCMASTER-CARR PART NO. 8187T24
BASE PLATE MCMASTER-CARR PART NO. 8187T48
ADJUSTMENT SCREW (LEVEL TO 18 IN.) MCMASTER-CARR PART NO. 8187T49

NOTES

SCAFFOLDING IS APPROX. WIDTH 7 FT, DEPTH 5 FT, HEIGHT 36-54 IN. ADJUSTABLE
UNITS ARE INCHES UNLESS OTHERWISE NOTED
PIPE IS FIELD-FITTED USING STANDARD LENGTH NIPPLES (APPROX. 6")
EXCEPT WHERE INVOLVING THE SPACING OF INSTRUMENTATION HOLES.

FRONT VIEW

A.2.5 Wellhead Instrumentation

The wellhead manifold contains several instruments.

The instruments and their operating ranges, limits of accuracy, and type are shown in Table A-6. For the Phase I operations, the wellhead instrumentation for the extractor well is a pressure gage, pressure transmitter, and a pressure-indicating transmitter. The monitoring wellhead instrumentation is a pressure-indicating transmitter on each well. A flow meter will be placed on one well in the future to measure the flow in and out of a well due to the changes in barometric pressure.

Table A-6. Wellhead Instrumentation.

Instrument	Operating Range	Limit of Accuracy	Type
Flow Meter	0 to 1,400 ft^3/min	2% of scale	Manual Readout *
Pressure Gage	0 to 1 inch of water	2% of scale	Manual Readout *
Pressure Gage	0 to 10 inches of water	2% of scale	Manual Readout *
Pressure Gage	0 to 150 inches of water	2% of scale	Manual Readout *
Pressure Gage	0 to 10 inches of mercury	2% of scale	Transmitter **

* "Indication Only" sticker required. Large face gages.
** "Calibration" sticker required.

General specifications for the wellhead instruments are as follows:

- All transmitters have calibration standards traceable to the National Bureau of Standards.
- All instruments, including transmitters, are individually labeled.
- Calibration, or indication only, stickers shall be attached as required for the location.
- Input and output 4 to 20 mA DC.
- Control output 120 V AC.
- Discrete input and output.
- Excitation power from the process control system.

- Temperature range is -10°F to 110°F and the scale accuracy limit is ±2%.
- Vacuum pressure range is 0 to 10 inches of water and the scale accuracy limit is ±2% for the intervals measured.
- Extraction interval vacuum pressure range is 0 to 150 inches of water and the scale accuracy limitation is ±2%.
- Flow rate range is 0 to 1,500 std ft^3/min and the scale accuracy limit is ±2%.
- Transmitting lines from each well connect to the test unit computer station.
- Distance or the presence of other electrical fields does not alter the electrical signal.

A.2.6 Well Field Hose and Hose Heaters

The heaters will raise soil-gas temperature to a maximum 200°F for 50 to 500 ft^3/min flow. They will be installed as required to prevent water condensation.

The heater has inlet and outlet thermocouples. These thermocouples are monitored by the process control system. When heat is required, the heat power is turned on at the electric panel for that particular heater. This activation is recorded in the historical subroutine. When heat is no longer required, the power is shut off and recorded accordingly. During the Phase I operations, a hose heater will not be used. The hose heaters will be installed for use during the Phase II operations.

A.3 PROCESS SYSTEM

A.3.1 HEPA Trailer

The HEPA trailer accepts the soil vapor from the wellheads. The HEPA filters remove particulates from the soil vapor. Sampling ports prior to the HEPA filter are provided for gas sample collection.

The trailer deck is leveled with installed jacks and grounded with two sets of grounding rods. For the physical layout, see Figures A-11 through A-16. The components of the HEPA trailer are described.

Figure A-11. Test Unit HEPA Trailer - Top View.

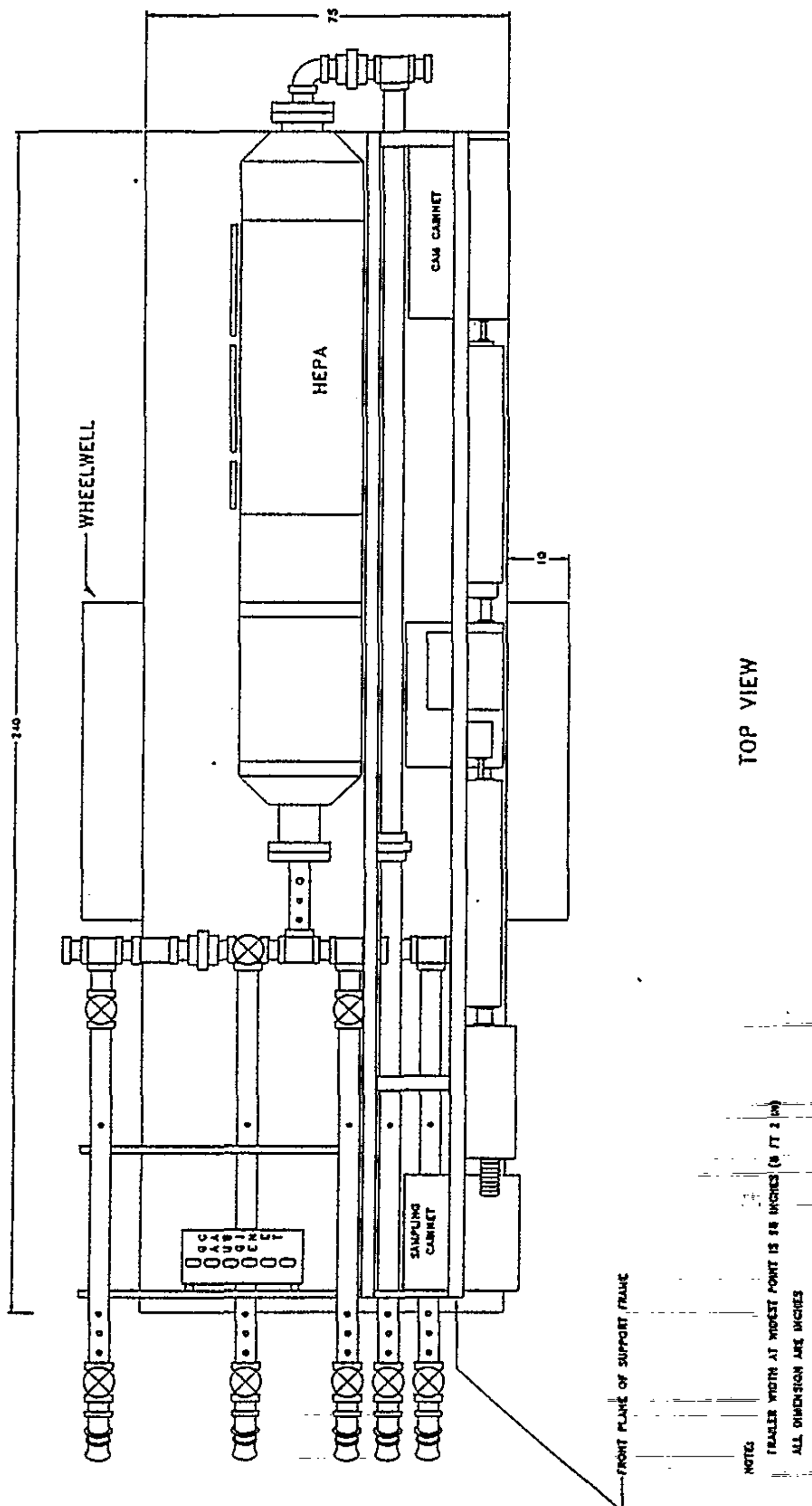


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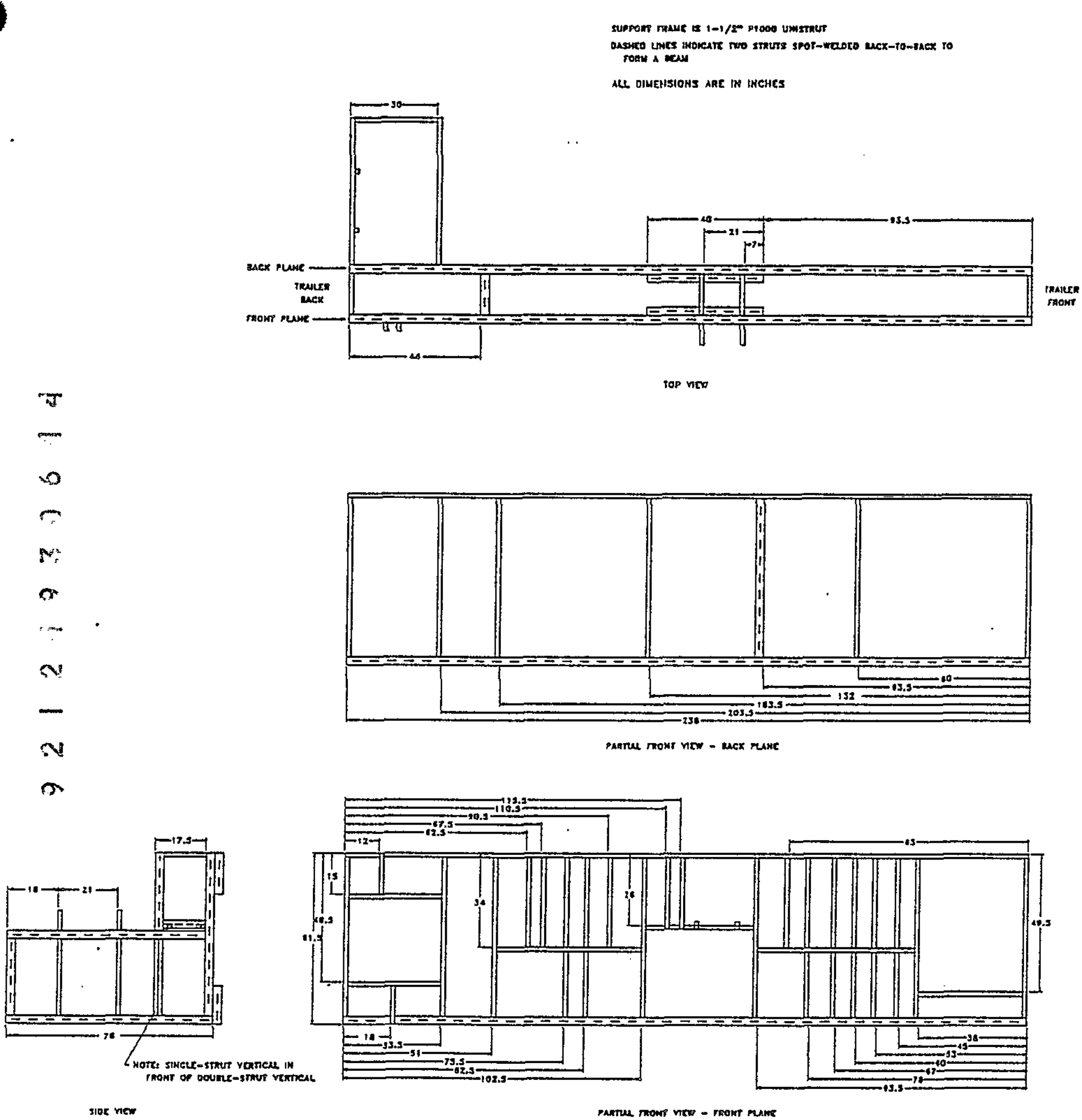
Figure A-12. Test Unit HEPA Trailer Support.



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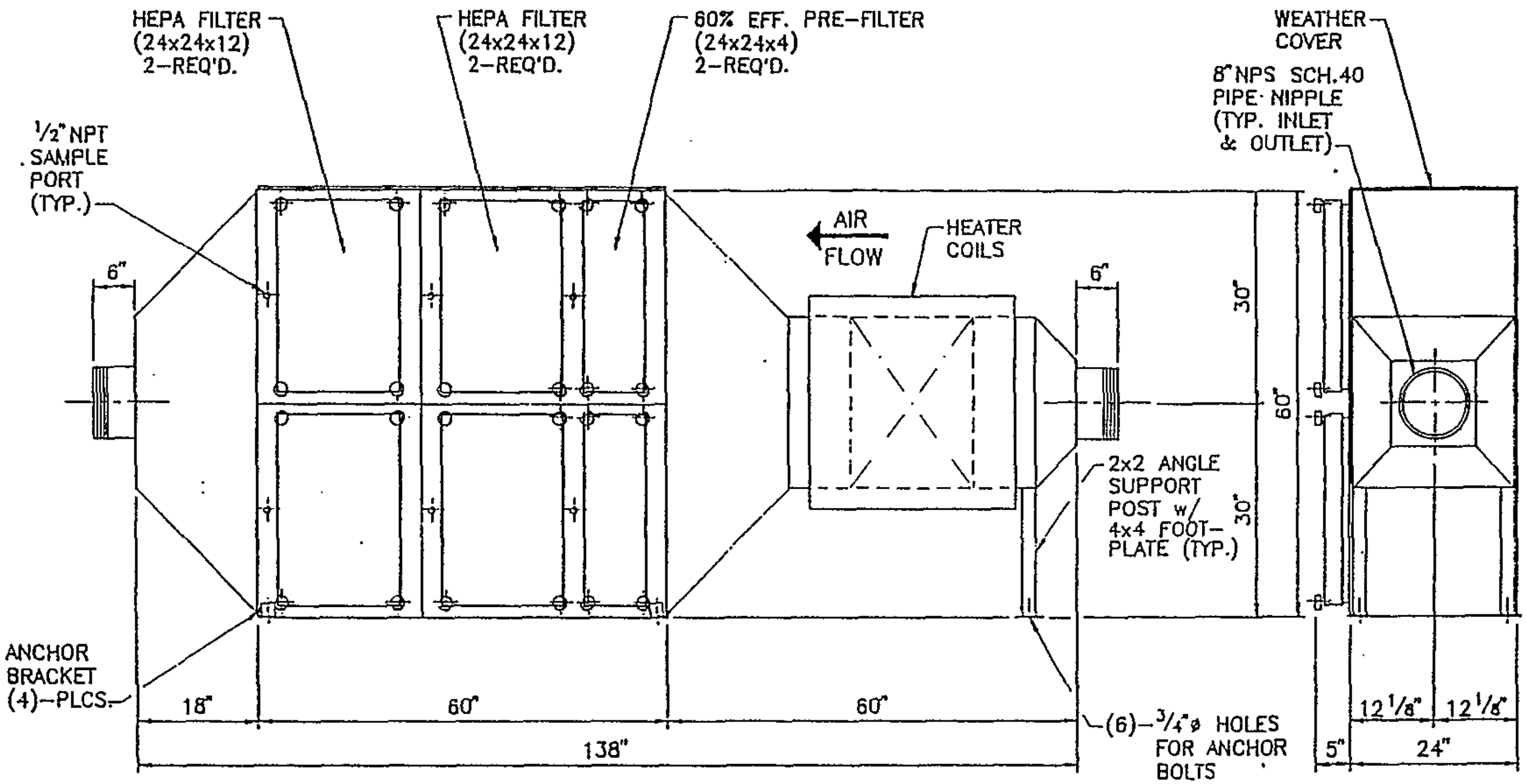


NOTES: 1.) MATERIAL- 304 ST.STL. (14 GA. MIN)
(REINFORCED WITH STRUCTURAL ANGLES)
2.) INSTALLED WT.(APPROX.)- 1180 LBS.
3.) CAPACITY- 1500 SCFM
4.) UNIT SHALL BE DESIGNED TO WITHSTAND
-10" Hg VACUUM. (-136" W.G.)

SCALE 1=16

Figure A-13. HEPA Filter Housing.

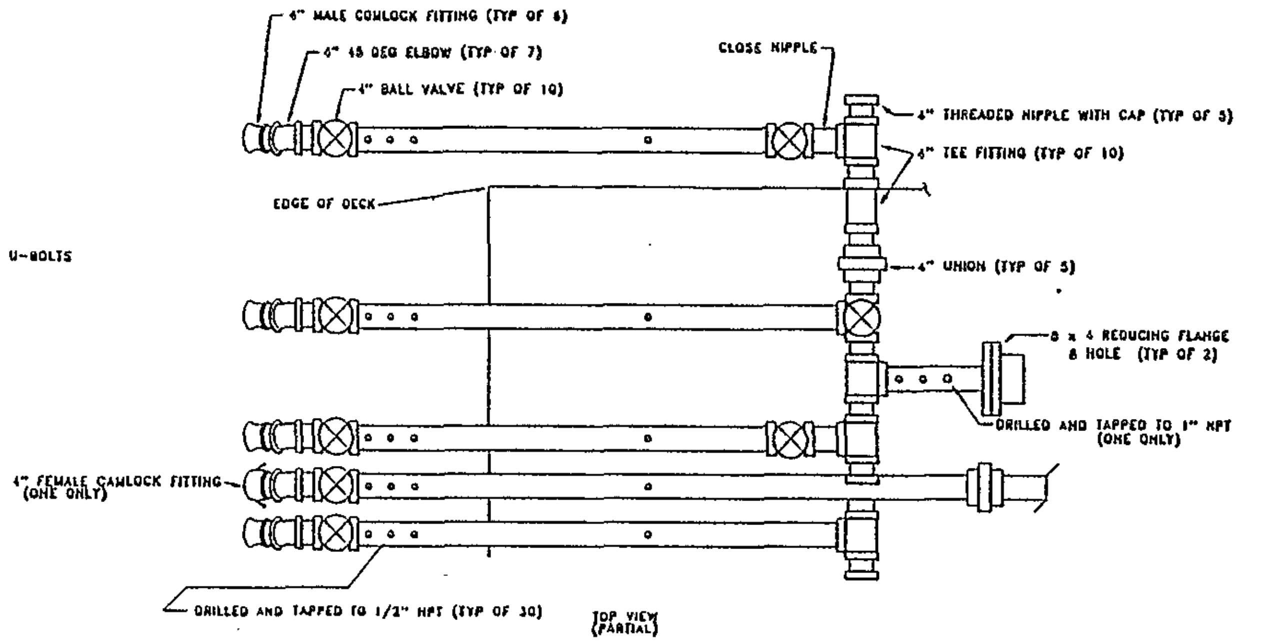
NOTES:

PIPES A, B, C, D ARE FROM THE WELLFIELD
PIPE E IS THE EFFLUENT
PIPE O GOES OUT TO WATER SEPARATOR
PIPE I IS IN FROM WATER SEPARATOR

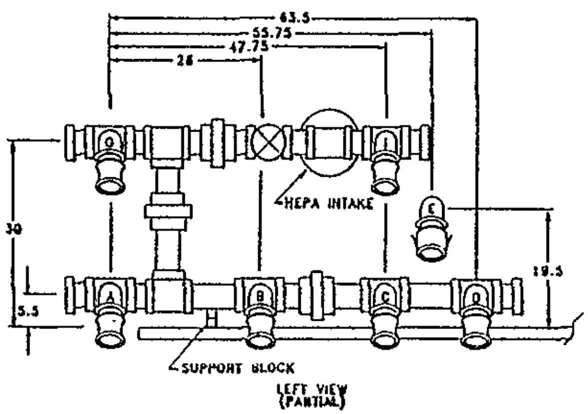
ALL PIPE IS 4" DIA. 40S, C.S.

PIPE IS FASTENED TO DECK AND SUPPORT STRUTS WITH U-BOLTS

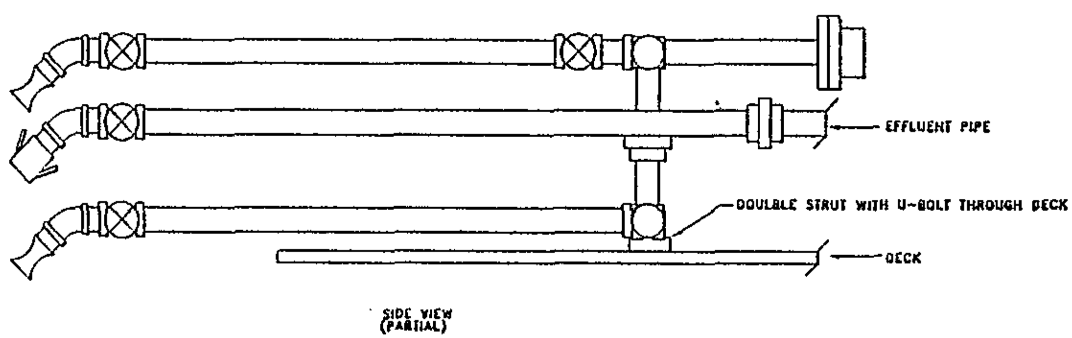
ALL DIMENSIONS ARE IN INCHES



TOP VIEW
(PARTIAL)



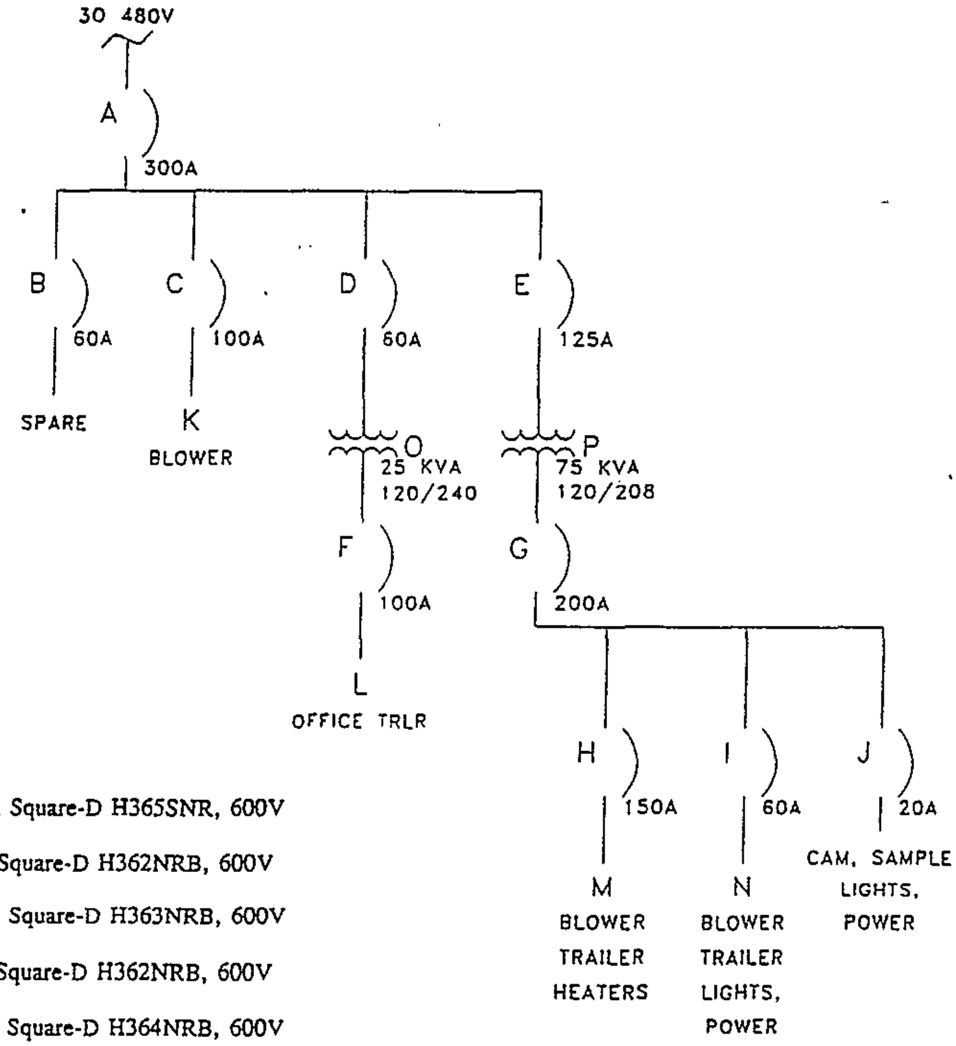
LEFT VIEW
(PARTIAL)



SIDE VIEW
(PARTIAL)

Figure A-14. HEPA Trailer Sample Lines.

Figure A-15. HEPA Trailer Electrical One-Line.



KEY

A. 400 Amp Safety Switch, Square-D H365SNR, 600V

B. 60 Amp Safety Switch, Square-D H362NRB, 600V

C. 100 Amp Safety Switch, Square-D H363NRB, 600V

D. 60 Amp Safety Switch, Square-D H362NRB, 600V

E. 200 Amp Safety Switch, Square-D H364NRB, 600V

F. 100 Amp Safety Switch, Square-D H323NRB, 240V

G. 200 Amp Safety Switch, Square-D H324NRB, 240V

H. 200 Amp Safety Switch, Square-D H324NRB, 240V

I. 60 Amp Safety Switch, Square-D H322NRB, 240V

J. Load Center 120/240V, Q02L40RB

K. 100 Amp Receptacle, Appleton ACJA1034-150

L. 100 Amp Receptacle, Appleton ACJA1034-150

M. 200 Amp Receptacle, Appleton AJ420034-150

N. 60 Amp Receptacle, Appleton ACRE6034-125

O. 25 KVA Transformer, Square-D 25S3H, 480V/120-240V

P. 75 KVA Transformer , Square-D 75T3H-0, 480V/120-208V

9 2 1 2 1 9 3 0 6 1 8

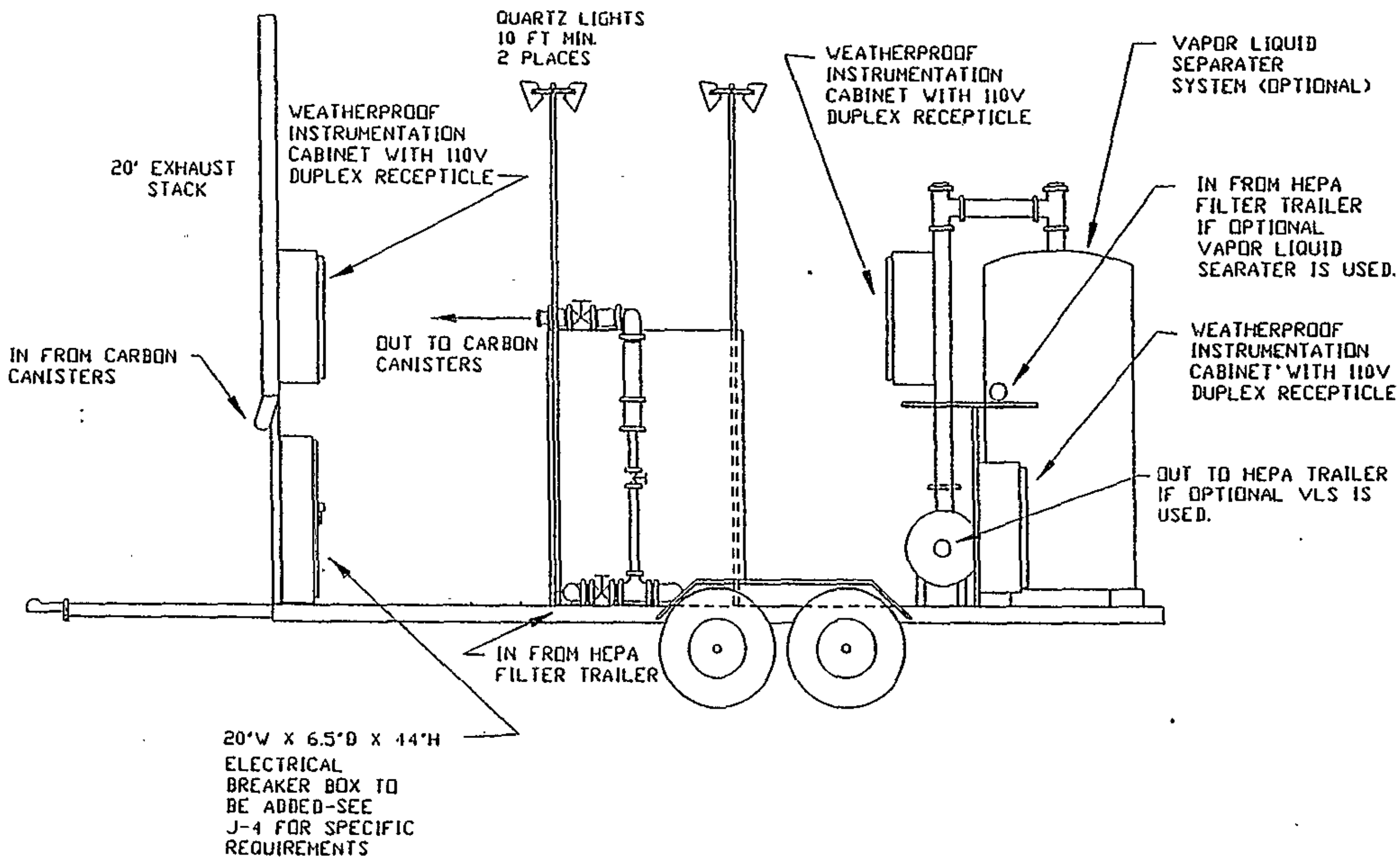


Figure A-16. HEPA Trailer Piping Layout.

A.3.2 HEPA Manifold

The manifold is located on the HEPA trailer and receives the well transfer hoses from the wells. All well soil vapor streams are combined in this manifold. The horizontal intake manifold consists of:

- Four equally spaced, 4-inch-diameter intake ports labeled in sequence, each with isolation/proportioning valves and quick release positive seal fittings.
- A sample line outlet connection (0.25-inch stainless steel tubing) upstream of each intake port valve.
- Influent and effluent lines for the use of the water knockout tank on the blower trailer.
- A 4-inch-diameter header to the HEPA filter housing.
- A 4-inch-diameter effluent line from the HEPA filter housing.
- A common sample cabinet return line connection to the manifold.

See Figures A-11 and A-14 for the HEPA trailer manifold and piping.

A.3.3 HEPA Filtration Unit

The HEPA filtration unit removes particulates from the soil vapor stream. The HEPA filtration unit has a prefilter and two filter banks. Detailed specifications are given below and in Figure A-13.

- Housing is made of stainless steel able to withstand 10 inches of mercury vacuum.
- Housing has anchor brackets for a flat deck installation.
- Height of the HEPA filter off the trailer is sufficient to allow easy and safe filter element changeout.
- Inlet and outlet ports have 4-inch diameters and NPT pipe.
- Is capable of meeting leak test criteria per ANSI/ASME N509 (ANSI 1989a) and ANSI/ASME N510 (1989b).
- Prefilter contains:
  - 2 x 1 - minimum 50% efficient, 200°F, 1,000 ft^3/min, and 100% relative humidity elements in parallel.
  - An element size of a common off-the-shelf type which is installed in the unit.
  - Bag-in/bag-out equipment.
  - 2 x 1 element stacking.

- Both HEPA filter banks contain:
  - 2 x 1 element stacking.
  - Bag-in/bag-out equipment.
  - A 24- by 24- by 12-inch element size.
  - DOP test ports.
  - Gasket seals.
  - Pipe fitting (0.5 inch internal thread) for CAM isokinetic probe.
  - Differential pressure gage across each HEPA filter bank (0 to 3 inches of water).

A.3.4 HEPA Trailer Sampling System

The sampling system consists of a sampling cabinet on the HEPA trailer, piping to and from the cabinet, a sampling pump (if required), and seven sampling ports. The sampling ports are located on each of the four incoming well field lines, on the water knockout tank lines, and on the HEPA trailer effluent line. The sampling system is used to obtain samples to send to laboratory for analysis. See Figure A-14 for the layout of the sample cabinet lines.

The sampling cabinet provides a working space and weather proofing for sampling activities. Sampling cabinet specifications are listed below.

- A weatherproof enclosure at the right rear of the trailer.
- Access from the outside facing into the trailer.
- Glass view panels and lock open hatches.
- Interior dimensions of 30- by 30- by 24-inch deep.
- Sample line inlets with individual isolation valves.
- A common sample exhaust line that returns to the intake manifold through an isolation valve and common return line.
- An isolation transfer chamber to remove all samples.
- A 110-V outlet to power a portable vacuum pump.
- Interior light.

The sampling system tubing connects the sampling cabinet to the sampling ports. The piping is stainless steel, which does not interfere with the sample quality. The piping connections (fittings and needle valves) provide access and control at all desired locations and are shown in Figure A-17.

The sampling pump is used to pull a vacuum to obtain soil vapor samples as required. It is a 110-V, single-phase, motor-driven pump.

9 2 1 2 1 9 3 7 6 5 1

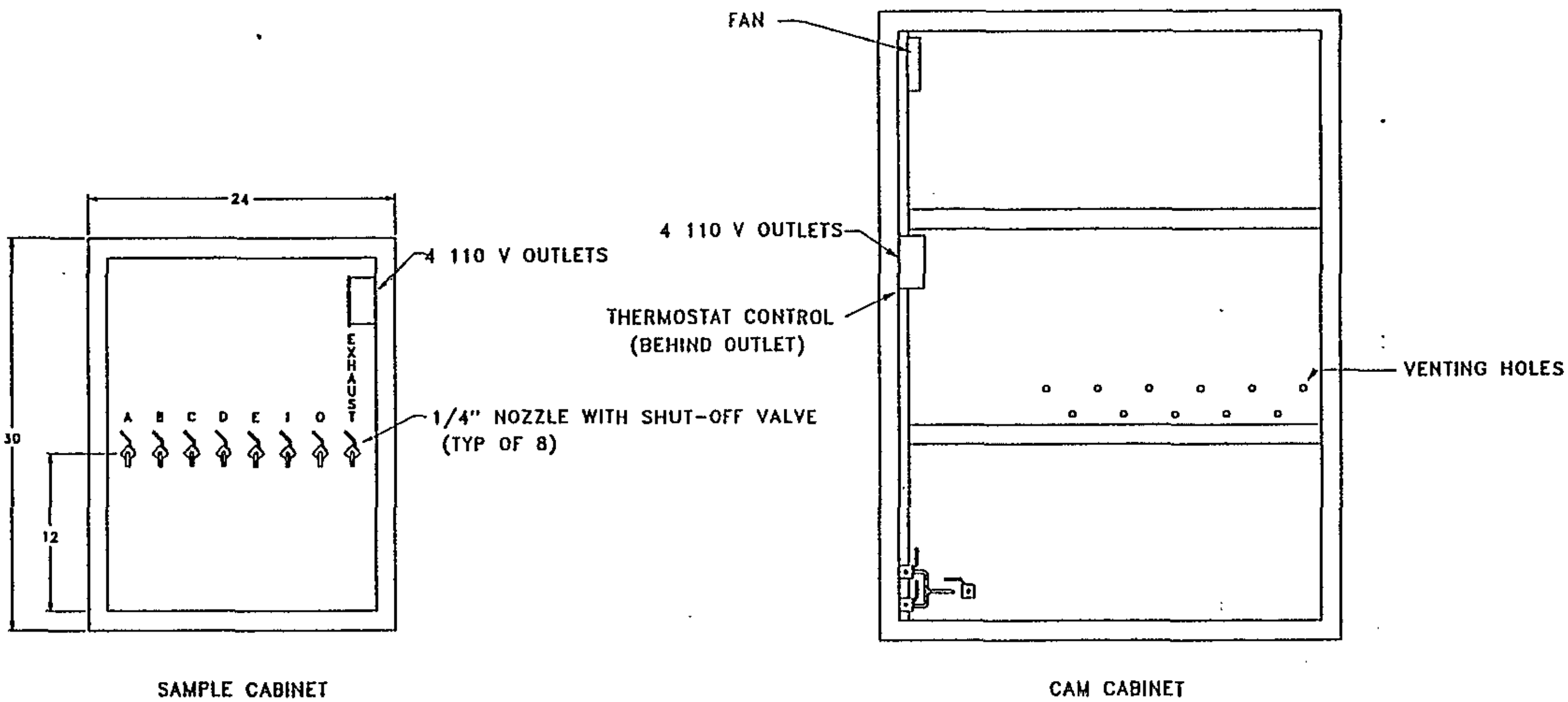


Figure A-17. (Need Title) Piping Connections

A.3.5 HEPA Trailer Electrical Service

Electrical service requirements for the HEPA trailer are given below. The HEPA trailer electrical one-line sketch is shown in Figure A-15 and the elec-trical enclosure layout is shown in Figure A-18.

- All wiring and equipment meet or exceed National Electric Code.
- HEPA trailer electrical system accepts incoming power for VES. It distributes the power to the blower and office trailer.
- 110-V outlets are in the CAM and sample cabinets.
- All circuits are clearly labeled in the panel box(s).
- HEPA trailer circuits
  - 480-V, three-phase
    blower trailer feed — 100 amps
    75 kVA transformer (supplies 208/110-V service) — 200 amps
  - 220-V, three-phase
    feed to lower trailer — 200 amps
    feed to office trailer — 100 amps
  - 110-V, single-phase CAM — 20 amps
  - 25 kVA transformer
  - 110-V blower trailer feed.

A.3.6 HEPA Trailer CAM Cabinet

Two process CAM are enclosed in a cabinet on the HEPA trailer. The first CAM measures the alpha radiation between the first and second HEPA filter banks. The second CAM measures the beta and gamma radiation between the first and second HEPA filter banks. See Figure A-14 for the layout of the CAM cabinet lines and Figure A-18 for the layout of the CAM cabinet.

Process CAM have their own audio-visual alarms. They also send alarm information to the data logging computer, which has a high level alarm and can shut down the VES system if necessary.

The CAM cabinet sits on the HEPA trailer and houses the process CAM. The CAM cabinet specifications are listed below:

- Weather and dust tight.
- Provides minimum room for at least four units and a vacuum pump.
- Circulation cooling fan.
- Interior light and switch.
- Outside access facing into the trailer.
- Doors have glass panels and lock open latches.
- Interior dimensions are 48-by 48- by 24-inches deep.
- Sample lines are 0.375-in. stainless steel tubing.
- Recessed shelf.

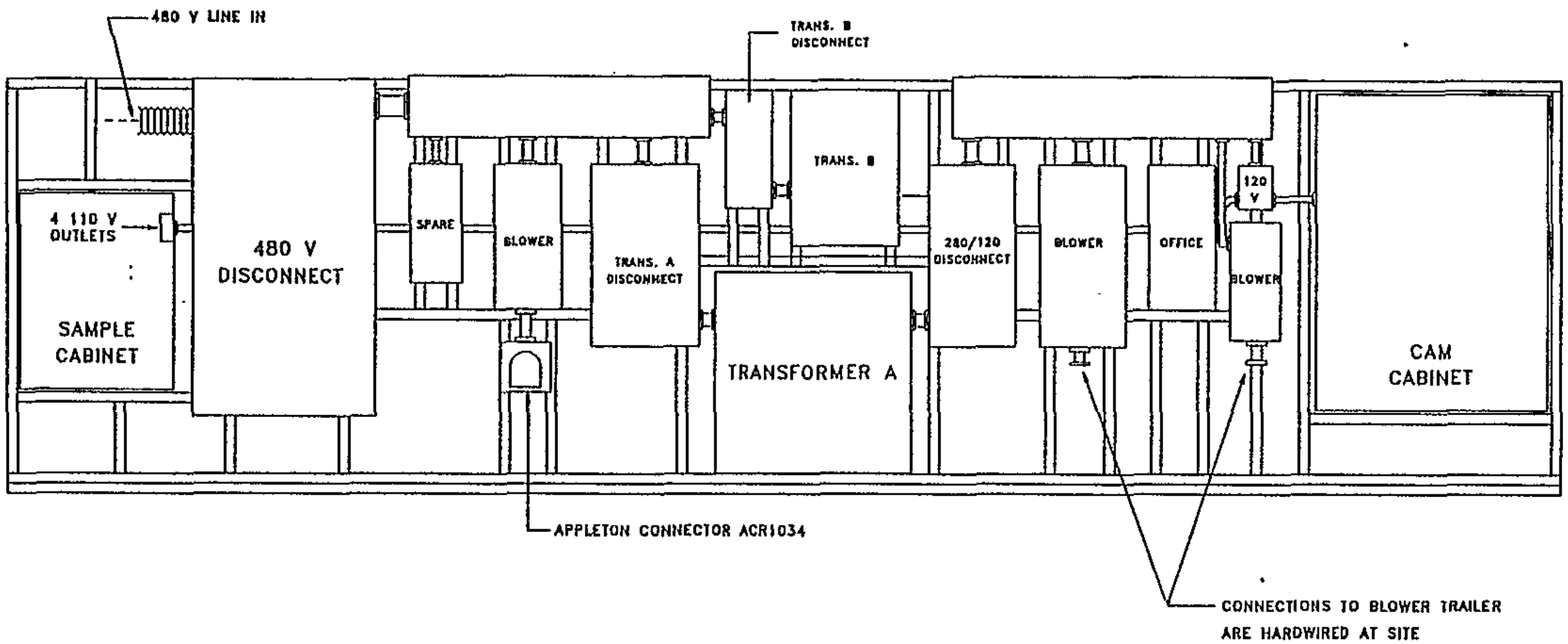


Figure A-18. (Need Title) Electrical Layout

A.3.7 HEPA Trailer Instrumentation

All HEPA trailer instrument transmitters connect to the VES process control system. See Figure A-1 and Table A-1. General instrumentation specifications are listed below.

- All transmitters are calibrated with the standards traceable to the National Bureau of Standards.
- Each manifold intake port has a (0 to 1,000 ft^3/min) flow meter and transmitter and a (1 to 15 inches of mercury) vacuum gage and transmitter.
- A (0 to 100%) relative humidity gage and transmitter, and a (0 to 200°F) temperature transmitter is installed between the intake manifold header pipe on the intake to the HEPA filter housing.
- Input and output 4 to 20 mA dc.
- Control output 120 V ac.
- Discrete input and output.
- Excitation power is from the process control system.
- Differential pressure across each of the two HEPA filter banks is measured with differential pressure gages.
- Soil vapor relative humidity is continuously measured prior to its entry into the HEPA filtration unit. The relative humidity range is 0 to 100% and the accuracy limit is ±2% of scale.
- Instrumentation wiring uses 18AWG shielded wires.

A.3.8 HEPA Trailer Piping

The piping layout is shown in Figure A-16. The specifications for the piping system are given below.

- Piping runs are located so that tripping hazards are not created.
- Piping is anchored so that no damage occurs from line vibration.
- All valves are individually labeled.
- All piping uses national pipe thread.
- Pipe is schedule 40 carbon steel
- 4-inch ball valves have a rating of 150 WSP and 600 WOG.

A.3.9 Blower Trailer

The blower trailer has a tongue jack and is grounded with two sets of grounding rods. For the physical layout of the blower trailer, see Figure A-19. The components of the blower trailer are described in the following sections.

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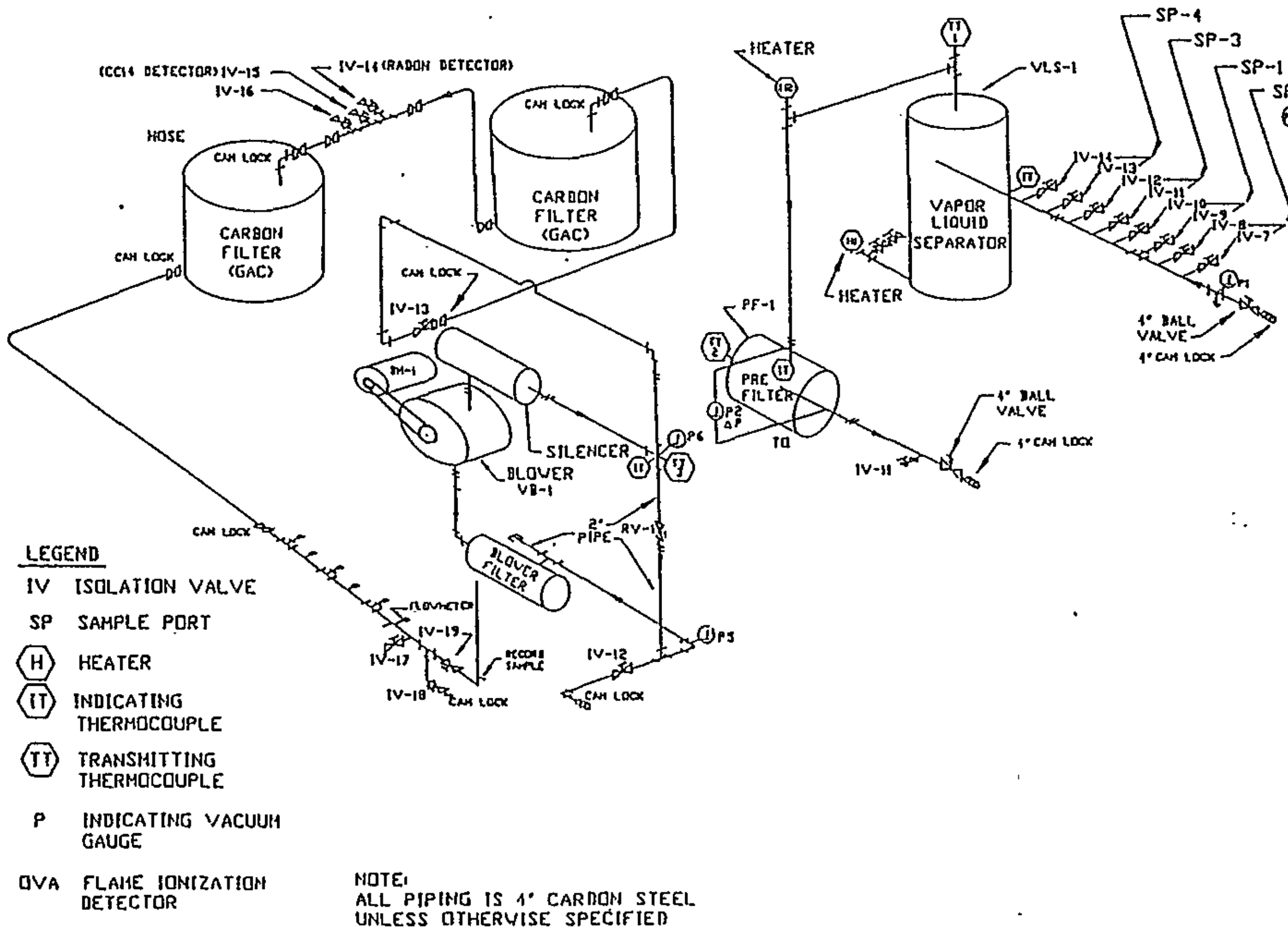

Figure A-19. Test Unit Blower Trailer.

A.3.10 Blower Module

The blower creates the airflow and vacuum for the entire system. It is the only moving part of the VES. It pulls the soil vapor from the subsurface of the well fields, through the HEPA filters, and into the blower. Then it pushes the soil vapor through the GAC canisters and through the stack to the atmosphere. The specifications for the blower are listed below:

- capable of continuous duty
- maximum capacity of 750 std ft^3min
- belt-driven
- provides up to 10 inches of mercury vacuum
- input and exhaust pipe size of 4 inches
- silenced to produce noise <85 dBA
- exhaust temperature of <225°F.

Purchase specifications are:

- Blower - Duroflow® blower model 4506, belt driven, p/n GGDVVAAA, quantity 1, weight 206 pounds
  - 4-inch-diameter connectors, p/n DR138987, quantity 2
  - discharge silencer, 4-inch-diameter, p/n DF193214, quantity 1
  - add oil per manufacturers instructions.

A.3.11 Blower Trailer Instrumentation

All blower trailer instrument transmitters connect to the VES process control system. See Figure A-1 and Table A-1 for the blower trailer instrumentation. General specifications for the instruments are given below.

- All transmitters are calibrated with the standards traceable to the National Bureau of Standards.
- All instruments, including transmitters, are individually labeled.
- Calibration, or indication only, stickers are attached as required for the location.
- Input and output 4 to 20 mA dc.
- Control output 120 V ac.
- Discrete input and output.
- Excitation power is from the process control system.
- Vacuum pressure range is 0 to 200 inches of water; scale accuracy limit is ±2%.
- Flow rate must be measured at the HEPA filter bank. The range of flow rate is 0 to 500 ft^3min and the scale accuracy limit is ±2%.

- Instrument cabinets for radon detectors and carbon tetrachloride detectors with power outlets and lights.
- Sensitivity of the radon meters os 0.1 pCi/L.
- Carbon tetrachloride detection ranges are 0 to 10 ppm and 0 to 2,000 ppm; scale accuracy limit is ±1%.

A.3.12 Blower Trailer Electrical System

Electrical services upgrades:

- Field install all wiring and equipment to meet or exceed the National Electric Code for NEMA 3R as shown in Figure A-18.
- Blower trailer 220-V panel is a 225-amp, three-phase, 208-V circuit breaker panel board (Square D part numbers from 12/90 DIGEST, page 1-3, 1-9, 6-5, 6-7, and 6-11).

Qty	Name	Part No.
1	Main Breaker kit	NQOD3200Q2MB
1	Interior	NQOD430L225CU
1	Enclosure, NEMA 3R	MH44WP
1	Interior trim kit	MH44TK
4	Breaker, 20-amp, 240-V	QOB320PL
3	Breaker, 20-amp, 110-V	QOB120GFI
8	Lockout	QO1PL

Dimensions 20- by 6.5- by 44-inches high

- All circuits are clearly labeled in the panels. Label the 20-amp, 240-V breakers, "Heater no. 1" through "Heater no. 4". Label the 110-V breakers "Lights", "Receptacles", and "Spare".
- Install hose heater 220-V, three-phase, 20-amp, three-pole, four-wire receptacles along the panel bottom. Each receptacle shall be numbered to correspond to breaker identification. Install: four 30-amp screwcap receptacles, weatherproof, Appleton p/n ACRE3034-75.
- All cables are UL listed as type TC, sunlight resistant and approved for direct burial (NEC Article 340), two- , three- , or four-conductor with ground.
- All connectors are Appleton style two-to-five wire, three-to-five pole, 600 V ac. Secure connectors to trailer so that they are not damaged when the trailer is moved.
- Assemble eight 100-ft hose heater cords using 8 AWG power cable, type TC, Houston Wire and Cable cat. no. 270100803 and use Appleton p/n ARCC3034BC connector assemblies. Tag each cable as "Hose Heater".

- Assemble one 25-ft 200 A cable. Use 4/0 AWG power cable, type TC, Houston Wire and Cable Cat. no. 271140103 and use Appleton p/n ARCC20034CD connector assembly.
- Blower trailer 208-V incoming feed connection - three-phase, 200-amp, four-pole, three-wire clamping ring plug, Appleton p/n AP20034CD. Will be mounted on the 208-V, 200-amp panel.
- Assembly one 35-foot 100 A cable. Use no. 2 AWG power cable, type TC, Houston Wire and Cable cat. no. 270100203 and use Appleton p/n ARCC1034CD connector assembly.
- Blower trailer 480-V incoming feed connection - three-phase, 100-amp, four-pole, three-wire clamping ring plug, Appleton p/n ACP1034CD, will be mounted on the 100-amp safety switch.
- Two photo-cell controlled, extension floodlight towers will provide lighting.
- Each tower consists of two adjustable 3,200-lm lights. Low-pressure sodium or incandescent lights will be used.
- Light tower extends to a minimum 10-ft height. Height setting is lockable.
- Each tower consists of two 360-degree horizontal and 270-degree vertical adjustable 3,200-lm lamps.
- Stands are similar to W.W. Grainger p/n 2V927.
- Weatherproof 110-V electrical duplex outlets are in each light tower base.

A.3.13 Blower Trailer Stack

The blower trailer exhaust receives soil vapor from the GAC canisters and exhausts it to the atmosphere. Exhaust stack has the following specifications.

- A base inlet 6 inches in diameter.
- A 20-ft vertical stack with a diameter of 6 inches.
- Constructed of steel gas vent pipe.
- Reinforced construction with ability to withstand up to 100 mph winds.
- Compliance recorder for record sample of radiation releases.
- Collapsible or removable for easy transportation.

A.3.14 Blower Trailer Piping

For the layout of the blower trailer piping, see Figure A-19. The blower trailer piping requirements are given below.

- Connections are threaded to NPT standard.
- Runs are located so there are no tripping hazards.
- Pipes are anchored so no damage occurs from line vibration or trailer movement.
- Valves are individually labeled.

A.4 TREATMENT SYSTEM

The treatment system consists of at least two GAC canisters placed in series. The GAC canisters receive the soil vapor from the well field after it has been filtered by the HEPA filters. The activated carbon in the canisters adsorbs the contaminant vapor molecules. The vapor is then pushed through the stack to the atmosphere.

The first GAC canister functions as the primary treatment system, while the second functions as the polishing system. When the primary canister reaches its sorptive capacity, it is taken offline to be regenerated. It is replaced immed-iately by the secondary canister. A regenerated canister replaces the secondary canister.

A.5 PROCESS AREA REQUIREMENTS

A.5.1 Electrical Power Requirements

Process area electric power requirements are supplied by pole power or a portable generator though not simultaneously. Electric load is 480-V, 400-amp, three-phase. Area lighting is provided with 10 footcandle at approximately a 30-foot radius around the office and blower trailers.

A.5.2 Change Area

The office trailer provides a change area for personnel to dress and undress with protective clothing as conditions warrant.

A.5.3 Accessibility

The process area is accessible to all authorized personnel and emergency vehicles. The area is kept weed free to reduce any fire hazards.

A.5.4 Parking

Adequate parking areas are identified that do no interfere with emergency access. A dedicated forklift parking area will be identified next to the office trailer for hot-start hookup.

A.5.5 Sanitary Water

Only potable drinking water is provided. Water bottles are located in the office trailer.

A.5.6 Sanitary Sewage

Portable toilet(s) are used to provide sewage collection. The location(s) do not interfere with process area access.

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APPENDIX B

SAMPLING AND ANALYSIS PLAN

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PART 1 - FIELD SAMPLING PLAN

B.1 SAMPLING

Sampling and analysis to support both subsurface and test unit monitoring are described in Sections 4.1 and 4.2, respectively. A summary of the plan (Table B-1) has been compiled from the descriptions of those monitoring tasks.

Table B-1. Field Sampling Plan.

Ident.	Location	Frequency	Purpose	Analyte
W15-6	Z-9	2/week	soil vapor baseline	CCl_4, radon
W15-8	Z-9			
W15-82				
W15-84				
W15-85				
W15-95	Z-9			
W18-1	W of Z-1A/Z-18			
W18-2	W of Z-1A/Z-18			
W18-6	Z-1A			
W18-7	Z-1A			
W18-9	Z-18			
W18-10				
W18-11				
W18-12	Z-18			
W18-17	E of Z-1A			
W18-18	SE of Z-1A			
W18-19	SE of Z-1A/Z-18			
W18-24	W of Z-1A/Z-18			
W18-82	Z-18			
W18-85	Z-1A			
W18-86				
W18-87				
W18-88				
W18-89	Z-1A			
W18-93	Z-18			
W18-94				
W18-95				
W18-97				
W18-98				
W18-99	Z-18			
W18-153	W of Z-1A/Z-18			
W18-157	W of Z-1A/Z-18			
W18-171	Z-1A	2/week	soil vapor baseline	CCl_4, radon

Table B-1. Continued

Ident.	Location	Frequency	Purpose	Analyte
C-1	Z-18	2/week	soil gas baseline	CCl4, radon
E-2	Z-1A/Z-18			
E-3				
N-2				
N-3				
N-5				
N-6				
N-7				
N-9	Z-1A/Z-18			
W-1	Z-18			
W-5	Z-18			
2W-15-06CP	Z-9			
	Z-18 ground			
	Z-1A ground			
	Z-9 ground			
	SW perim. fence			
	SE perim. fence			
	NW perim. fence			
	NE perim. fence			
W7-4	N perim. of plume	2/year	groundwater baseline	CCl4, CHCl3
W7-5	N perim. of plume			
W10-17	N of plume max			
W10-18	N of plume max			
W15-6	Z-9			
W15-8	Z-9			
W15-16	max. of plume			
W15-22	N of plume max			
W18-2	W of Z-18			
W18-9	Z-18			
W18-17	S perim. of plume			
W18-20	S perim. of plume			
W18-29	S perim. of plume			
6-38-70	E perim. of plume			
6-39-79	W of plume max			
6-43-88	W perim. of plume			
6-49-79	N perim. of plume		groundwater baseline	CCl4, CHCl3
W18-87A	33-38 ft	varies	extrac/monitor wells	CCl4, radon
W18-87B	65-70			
W18-87C	125-130	varies	extrac/monitor wells	CCl4, radon

Table B-1. Continued

Ident.	Location	Frequency	Purpose	Analyte
W18-150A	62-67	varies	extrac/monitor wells	CCl4, radon
W18-150B	82-87			
W18-150C	111-116			
W18-165	122-127			
W18-166	124-129			
W18-167	114-119			
W18-168	118-123			
W18-171A	20-25			
W18-171B	57-77			
W18-171C	115-130	varies	extrac/monitor wells	CCl4, radon
D	HEPA Trailer	hourly	opers/monitoring	rel humid
TE	HEPA trailer	hourly		temp
FM	monitoring wells	varies		flow rate
PT	extraction well	varies		pressure
TC	water heater	2/day		temp
PIT	extraction well	varies		pressure
RT	HEPA bank	hourly		radiation
PTA	HEPB trailer	hourly		pressure
RTC	treatment system	varies		radon
CT	treatment system	varies		CCl4
TTA	HEPA trailer	hourly		temp
PI	HEPA bank	varies		pressure
TG	blower trailer	varies		temp

PART 2 - QUALITY ASSURANCE PROJECT PLAN

B.2 PHASE II - SITE EVALUATION

B.2.1 Project Description

The primary objective of the 200 West Area Carbon Tetrachloride Expedited Response Action (ERA) is to remediate carbon tetrachloride vapors in the unsaturated sediments in the 200 West Area. The descriptions of the physical characteristics of the ERA site, nature, and extent of contamination are included in Section 2.0, Summary of Physical and Contaminant Characteristics.

B.2.2 Project Organization and Responsibilities

Key personnel and organizations necessary for ERA activities are outlined in the Appendix C, project management plan (PMP). The PMP includes a chart indicating organization and line of authority.

B.2.3 Quality Assurance (QA) Objectivs for Measurement

Most thermal samples will be analyzed with a portable gas chromatograph or other field screening equipment. Field screening with a calibrated instrument is adequate for determining concentrations, and the results are required in real time. Accuracy, precision, and detection limits of the instrument will be determined during field calibration and documented. Laboratory screening will be technically correct using a calibrated instrument and documented. Groundwater samples submitted to PNL for comparative analysis will be analyzed for volatile organics according to applicable procedures in the February 1988 EPA Contract Laboratory Program Statement of Work for Organics Analysis Multimedia/Multiconcentrations Exhibit D.

B.2.4 Procedures

Westinghouse Hanford Company (Westinghouse Hanford) procedures that will be used to support the sampling plan have been selected from the *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan* (WHC 1990), which will be included in the Westinghouse Hanford QA program plan for Comprehensive Environmental Response, Compensation, and Liability Act of 1980 RI/FS activities. Selected procedures include environmental investigations instructions (EII) from the *Environmental Investigations and Site Characterization Manual* (WHC 1988), and quality requirements (QR) and quality instructions (QI) from the Westinghouse Hanford *Quality Assurance Manual* (WHC 1988a).

The sampling tasks are discussed in Chapter 4, Monitoring. The EII will govern these tasks as applicable. Tasks performed by subcontractors or participant contractors will comply with applicable portions of the EII (WHC 1988) and/or with Westinghouse Hanford-approved subcontractor or participant contractor procedures. Procedures for the cone penetrometer test (Task 4) will be included in the test plan for that task.

Procedural approval, revision, and distribution control requirements applicable to EII are addressed in EII 1.2, Preparation and Revision of Environmental Investigations Instructions. Deviations from established EIIs that may be required in response to unforseen field situations may be authorized in compliance with EII 1.4, Deviation from Environmental Investigations Instructions. In the event of a time constraint, deviations from procedures may be documented in, for example, field logbooks.

Sampling locations, frequencies, and analyses are described in Chapter 4 and Part 1 of the Sampling and Analysis Plan.

B.2.5 Sample Custody

Sample custody will be maintained if sample analysis does not immediately follow sample collection. Results of analyses shall be traceable to original samples through the unique code or identifier assigned to the sample in the field. Results of field investigations will be controlled according to the Data Management Plan, Appendix F.

B.2.6 Calibration Procedures

Calibration of measuring equipment will be done according to procedure manuals governing its use. Calibration of Westinghouse Hanford, participant contractor, or subcontractor analytical equipment shall be as defined by applicable standard analytical methods, subject to Westinghouse Hanford review and approval.

B.2.7 Analytical Procedures

Analytical methods are identified in Chapter 4, Monitoring. Procedures based on these methods will be selected or developed and approved prior to use in compliance with Westinghouse Hanford procedures and/or procurement control requirements.

B.2.8 Data Reduction, Validation, and Reporting

The task coordinator or designate for each task will be responsible for preparing a report summarizing the results of analyses and for preparing a detailed data package that includes all information necessary to perform data validation as required. As a minimum, data packages will include:

- Sample documentation, including identification of the organizations and individuals performing the extraction and analysis; the signatures of the responsible extractor and analyst; documentation of any sample custody; and the date/time of sample extraction and analysis.

- Instrument calibration documentation, including equipment type and model, for the time period in which the sample analysis was performed.
- Quality control data for the methods used.
- Analytical results or data deliverables, including reduced data, reduction formulae or algorithms, and identification of data outliers or deficiencies.

B.2.9 Internal Quality Control

Internal quality control methods, such as the use of field duplicate samples and field blanks, will be used. As feasible, duplicate samples will be analyzed by both field screening equipment and laboratory screening equipment.

B.2.10 Performance and Systems Audits

Audits in environmental investigations are considered to be systematic checks that verify the quality of operation of one or more elements of the total measurement system. Performance audit requirements will be met by the use of internal quality control methods. Systems audits will be scheduled if requested by the project lead, project scientist, or the DOE Richland Field Office.

B.2.11 Preventive Maintenance

All measurement and testing equipment used in the field that directly affects the quality of the analytical data shall be subject to preventive maintenance measurements that ensure minimization of measurement system downtime. Field equipment maintenance instructions shall be as defined by the approved procedures governing their use.

B.2.12 Data Assessment Procedures

Measurement data will be assessed and documented for qualities such as precision and accuracy by the task coordinator or designate responsible for that measurement.

B.2.13 Corrective Actions

In the context of QA, corrective actions are procedures that might be implemented on samples that do not meet QA specifications. A corrective action request might be generated (e.g., by an audit). Corrective actions may include resampling or reanalyzing samples, if feasible. The primary responsibility for corrective action resolution is assigned to the project scientist and project lead.

B.2.14 Quality Assurance Report

Copies of all QA documentation, such as audits and corrective action resolutions, will be routed to the project QA records upon completion of the sampling and analysis activities. Data quality information related to the field investigation activities will be summarized in appropriate project reports.

B.3 REFERENCES

EPA, 1987, *Data Quality Objectives for Remedial Response Activities*, vol. 1, Development Process, EPA-540/6-87-003, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, U.S. Environmental Protection Agency, Washington, D.C.

WHC, 1988, *Environmental Investigations and Site Characterization Manual*, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988a, *Quality Assurance*, WHC-CM-4-2, Westinghouse Hanford Company, Richland, Washington.

WHC, 1990, *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan*, WHC-EP-0383, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX C

PROJECT MANAGEMENT PLAN

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of the project management plan is to define the administrative and institutional tasks necessary to support the design, operations and monitoring of the vapor extraction system (VES) as part of the 200 West Area Carbon Tetrachloride Expedited Response Action (ERA). The plan defines the responsibilities of the various participants, organizational structure, project tracking, and reporting.

1.2 BACKGROUND

The 200 West Area Carbon Tetrachloride ERA is being conducted by the U.S. Department of Energy (DOE) at the direction of the U.S. Environmental Protection Agency (EPA) and the Washington Department of Ecology (Ecology) as a provision of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). An ERA allows expedited activities to be undertaken at waste sites where early remediation will abate imminent hazards or prevent significantly increased degradation that might occur if action were delayed until completion of a remedial investigation/feasibility study (RI/FS) and record of decision. The ERA is being initiated based on concerns that the carbon tetrachloride residing in the soils underlying the 200 West Area is continuing to serve as a source of contamination to the ground water. Thus, the purpose of the ERA is to minimize contaminant migration within the unsaturated soils in the 200 West Area by removing the carbon tetrachloride.

Based on results of a vapor extraction pilot test conducted in the spring of 1991 and an engineering evaluation/cost analysis, the EPA issued an Action Memo directing the initiation of the first phase of soil vapor extraction in the 200 West Area. The proposed action for removing the carbon tetrachloride in the unsaturated soils is to use soil vapor vacuum extraction with aboveground collection of the carbon tetrachloride on granulated-activated carbon, using a network of soil vapor extraction vadose wells. The activated carbon will be sent offsite to be regenerated and carbon tetrachloride destroyed.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Figure C-1 shows the regulatory organizational interfaces for the 200 West Area Carbon Tetrachloride ERA. The ERA is conducted under the lead of the EPA per the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) (Ecology et al. 1989). The specific responsibilities of EPA, Ecology, and DOE are detailed in the Action Plan of the Tri-Party Agreement. Westinghouse Hanford Environmental Engineering Group is the technical lead for 200 Area operable units and any remedial actions.

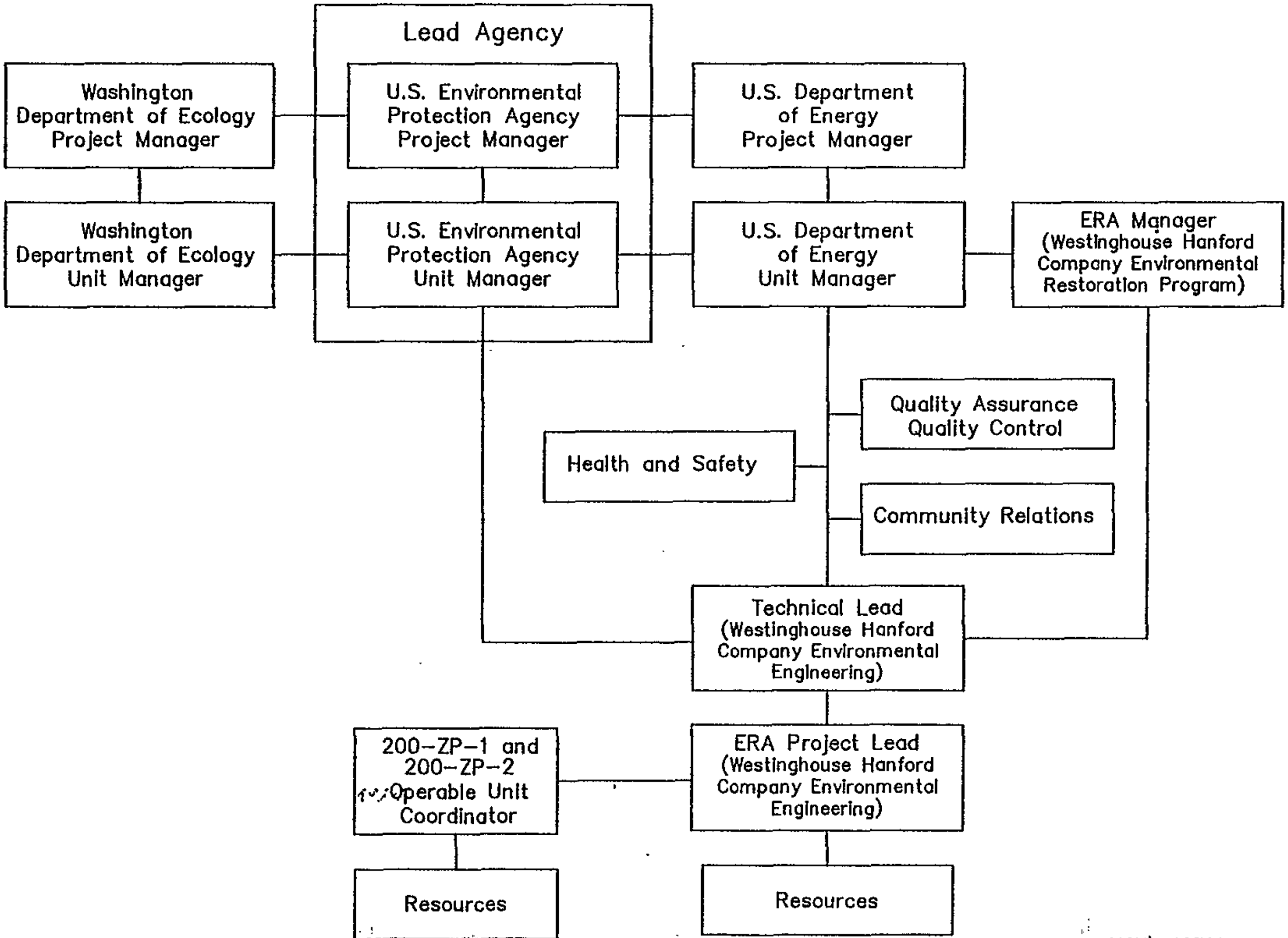

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Figure C-1. Regulatory Interfaces.

The VES operations will be performed by a 200 West Area Carbon Tetrachloride ERA and Volatile Organic Compounds - Arid Integrated Demonstration (VOC-Arid ID) team (Figures C-2 and C-3), led by the Westinghouse Hanford Environmental Engineering Group. The ERA/VOC-Arid ID Operations Team is responsible for site characterization, VES engineering and operations, and regulatory and DOE/Westinghouse Hanford compliance. The principal organizations conducting these activities are:

- **Operations·Management** - Westinghouse Hanford Environmental Engineering Group provides the project management lead and coordinates technical resources for the ERA and VOC-Arid ID.

- **Site Characterization/Well Field Evaluation** - Westinghouse Hanford Geosciences Groiup plans, manages, coordinates site characterization activities and VES well field evaluation.

- **Project Engineering** - Westinghouse Hanford Environmental Engineering Group is responsible for the overall design operations and monitoring of the VES and any associated safety assessments.

- **Field Services** - Westinghouse Hanford Environmental Field Services Group supports site characterization and project engineering needs in the field, including coordinating field activities as the field team leader for operations and monitoring of the VES.

- **Regulatory Analysis** - Pacific Northwest Laboratory and Westingyhouse Hanford Regulatory Analysis Group ensures regulatory compliance with federal, state, and local environmental requirements for characterization, operational, monitoring activities.

- **Quality Assurance** - Westinghouse Hanford Environmental Quality Assurance is responsible for coordinating and monitoring performance of the quality assurance project plan requirements by means of internal surveillance techniques and by auditing. Quality Assurance retains the necessary organizational independence and authority to identify conditions adverse to quality, and to inform the technical lead of needed corrective action.

- **Health and Safety** - Westinghouse Hanford Environmental Field Services Group is responsible for monitoring all potential health and safety hazards, including those associated with radioactive, volatile, and/or toxic compounds during sample handling and sampling decontamination activities. The health and safety officer has the responsibility and authority to halt field activities resulting from unacceptable health and safety hazards.

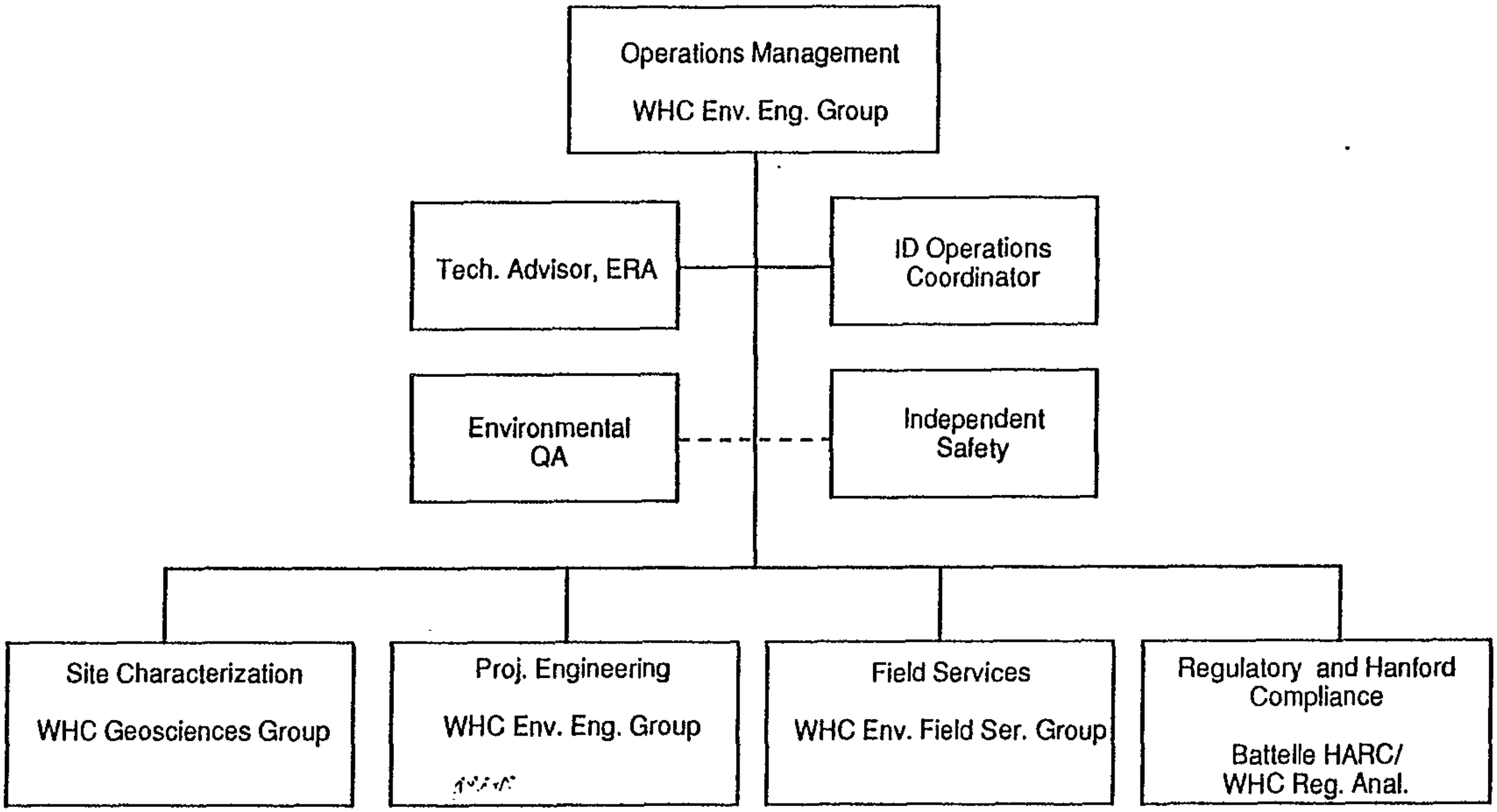

Figure C-2. 200 West Area Carbon Tetrachloride ERA and VOC-Arid ID Operations Team.

9 2 1 2 4 9 3 0 6 3 0

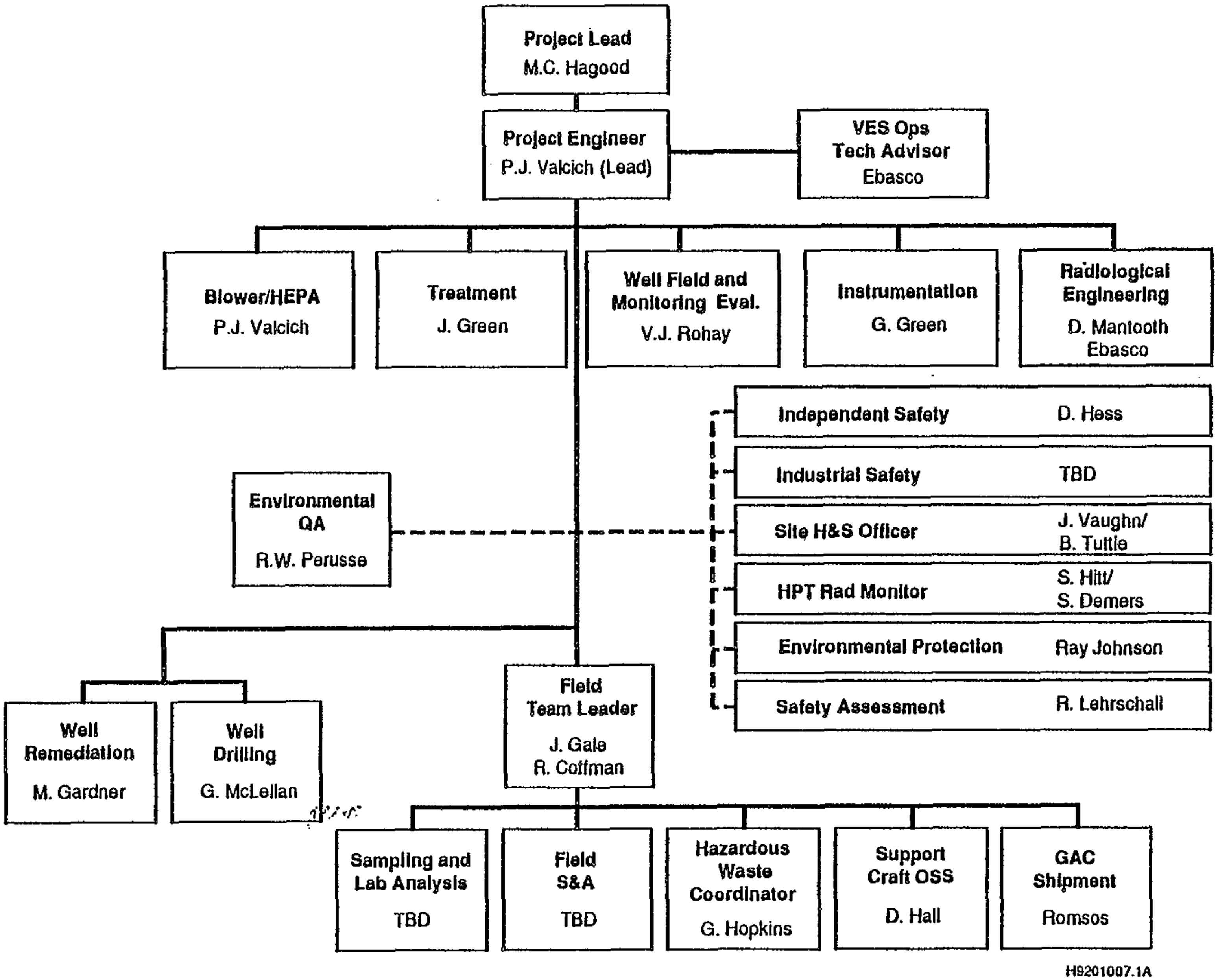

Figure C-3. VES Operations Team.

3.0 INTERFACES

3.1 AGGREGATE AREA MANAGEMENT STUDIES

The 200 West Area Carbon Tetrachloride ERA activities are to be conducted on inactive disposal sites located within the 200-ZP-1 and 200-ZP-2 operable units, which have not been initiated and do not presently have specific Westinghouse Hanford coordinators assigned. However, an aggregate area management study (AAMS) of Z Plant in the 200 West Area has been proposed to be conducted concurrently with the ERA. The purpose of conducting an AAMS is to compile and evaluate the existing body of knowledge and conduct limited field characterization work to support the Hanford Past-Practice Strategy (DOE-RL 1991). The primary objective of the strategy document was to develop a uniform streamlined process to meet statutory requirements with a "bias for action" by maximizing the use of existing data, integrating past practice with Resource Conservation and Recovery Act of 1976 (RCRA) treatment, storage, or disposal unit closure investigations, limiting and focusing the RI/FS process, and conducting expedited and interim actions where appropriate.

The interface between the AAMS and the ERA will be determined at a later date and will be reflected in a revision of this project management plan. A Westinghouse Hanford technical coordinator has been assigned for this project and will interface with the ERA project lead. The regulatory lead for the AAMS is EPA and is supported by Ecology.

3.2 VOC-ARID ID

Another supporting activity that affects the design and operation of the VES is components of the VOC-Arid ID. The VOC-Arid ID is one of several DOE integrated demonstrations designed to support the testing of emerging environmental management and restoration technologies. The principal objective of the VOC-Arid ID at the Hanford Site is to determine the viability of emerging technologies that can be used to remediate arid or semiarid sites containing VOC (e.g., carbon tetrachloride) with or without associated metal and radionuclides contamination. During the first few years, The VOC-Arid ID activities focus primarily on the carbon tetrachloride contamination and associated contaminants found in the 200 West Area.

3.3 GROUNDWATER MONITORING ACTIVITIES IN 200 WEST AREA

Presently, 12 RCRA groundwater monitoring projects are being conducted in the 200 West Area (DOE 1991). The RCRA projects are monitored under three programs: (1) a background monitoring program; (2) an indicator evaluation program; and (3) a groundwater quality assessment program.

The DOE Richland Field Office (RL) functions as the lead agency for these monitoring programs and Ecology is the lead regulatory agency. Westinghouse Hanford is managing these activities for RL.

Within the 200 West Area, three other groundwater monitoring programs are in operation. The PNL assesses the impacts of Hanford operations on the groundwater for the DOE. Independent of this an evaluation of water quality is conducted by Westinghouse Hanford to ensure compliance with DOE monitoring guidelines, to assess the performance of waste disposal and storage facilities, and to determine the impacts of operations on the groundwater (Serkowski and Jordan 1989). In addition, a survey of drinking water sources at Hanford conducted by the Hanford Environmental Health Foundations (Somers 1989).

3.4 WASTE DISPOSAL PERMITTING

Several characterization studies may be conducted in the 200 West Area in support of applying for state waste discharge permits for the 10 currently active effluent streams in the 200 West Area. As part of this process, characterization activities in the Z Plant area will be conducted in support of the evaluation of the 216-Z-20 Crib as the site for the continuing liquid discharge from the Plutonium Finishing Plant. By June 1995, an alternative disposal pond for nine of these effluents will be emplaced. Site characterization activities are also planned in support of the permit application for this new pond.

3.5 PLUTONIUM RECLAMATION FACILITIY EMISSIONS ABATEMENT FS

An engineering FS to determine the sources of carbon tetrachloride air emissions and means of mitigating these emissions from solvent extraction columns, and organic makeup and waste solution tanks in the Plutonium Reclamation Facility solvent extraction system is being conducted by Westinghouse Hanford.

4.0 DOCUMENTATION AND RECORDS

All records and reports related to the VES operations will be forwarded to the Westinghouse Hanford Environmental Engineering Group for inclusion in the project records to be maintained by the project lead in accordance with Environmental Investigations Instruction 1.6, Records Management (WHC 1988). Appropriate records will also be incorporated into an official administrative record file which is available for public review.

5.0 FINANCIAL AND PROJECT TRACKING REQUIREMENTS

Westinghouse Hanford Environmental Engineering Group will have the overall responsibility for planning and controlling the VES operations, providing effective technical, cost, and schedule baseline management. The management control system used for this project must meet the requirements of DOE Order 4700.1, *Project Management System* (DOE 1987), and DOE Order 2250.1B, *Cost and Schedule Control Systems Criteria for Contract Performance Measurement* (DOE 1985). The Westinghouse Hanford Management Control System

(MCS) meets these requirements. The primary goals of the Westinghouse Hanford MCS are to provide methods for planning, authorizing, and controlling work so that it can be completed on schedule and within budget, and to ensure that all planning and work performance activities are technically sound and in conformance with management and quality requirements.

The VES operation schedule and major milestones are presented in Chapter 6. The schedule will be the primary guidance for the regulators, DOE, and the technical lead to track the progress of the operations.

6.0 MEETINGS AND PROGRESS REPORTS

The regulators, DOE, and Westinghouse Hanford participate in open discussions during weekly meetings to resolve issues related to the status of the ERA. These meetings provide for a continuing dialogue with the regulators. The status of the IRA will continue to be presented at ongoing unit managers meetings concerning the IRA. In addition, reporting will be conducted quarterly and annually (see Section 5.0) on the VES operations.

7.0 REFERENCES

DOE-RL, 1991, CARBON TET PROPOSAL , DOE/RL-91-38

DOE-RL, 1991, *Hanford Past-Practice Strategy*, DOE/RL-91-40, Draft A, U.S. Department of Energy, Richland Operations, Richland, Washington.

Ecology et al. 1989, *Hanford Federal Facility Agreement and Consent Order*, Washington Department of Ecology, U.S. Environmental Protection Agency, U.S. Department of Energy, Olympia, Washington.

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APPENDIX D

OPERATIONS AND MAINTENANCE

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D.1 OPERATION CONTROL

D.1.1 Control Points

The heaters control the temperature, which controls the relative humidity. The relative humidity controls the dew point of the vapor. If the vapor condenses to liquid, there is the potential for hazardous mixed waste. The relative humidity is a controlling function which shuts down the system when the humidity is high to protect the HEPA filters and the GAC canisters.

Control points:

- Hose heaters
  - control each individual hose heater temperature range
  - turn power on/off.

- HEPA trailer manifold
  - control well vacuum and flow rate
  - control carbon tetrachloride concentration levels.

- Vacuum blower
  - control vacuum and flow range
  - control exhaust pressure
  - control exhaust temperature
  - bypass valve
  - turn power on/off.

D.1.2 Alarm and Shutdown Points

Alarm and shutdown points:

- High system vacuum
  - compare PT5 and PT6 against 10 inches of mercury or current system configuration high vacuum limit
  - shut down system when vacuum exceeds limit by 0.2 inch of mercury

- High system pressure (PT7)
  - compare against 5 lb/in^2
  - shut down when pressure exceeds 5.5 lb/in^2

- High relative humidity (D)
  - shut down system pump when GTRH is >50%
  - alarm message "High Relative Humidity - check for water source".

- CAM set points (RT1, RT2)
  - shut down system pump when RT1 (alpha CAM) alarms
  - shut down system pump when RT2 (beta CAM) alarms

- High carbon tetrachloride level (CT2,3)
  - compare CT1 to 2,000 ppm vol carbon tetrachloride; shut down when CT1 >2,000 ppm vol
  - compare individual CT2 to >2,000 ppm vol carbon tetrachloride; shut down when individual CT2 >3,0000 ppm vol carbon tetrachloride
  - compare CT3 to 2 ppm vol; shut down when CT3 >25 ppm vol

- Flow rate change
  - compare FM5 to FM6
  - shut down when not within 10%

- High blower exhaust temperature (TT3)
  - compare TT3 to 225°F
  - shut down when TT3 >225°F

D.2 SYSTEM OPERATION

D.2.1 System Startup

The procedures for starting up the system following shutdown due to computer alarm or due to GAC canister changeout are as follows:

1. Observe and note cause of alarm condition and respond accordingly, noting time and cause of alarm and response actions taken.

2. Walk through system and check and document that all components appear functional and are properly connected.

3. Place all valves, including sample valves, in system in fully closed position with the exception of the following:

   - Place valves routed from selected extraction well(s) to blower in the fully open position

   - Place blower bypass valve in the fully open position

   - Place all valves downstream of the blower in the fully open position

   - Place valves routing flow straight into HEPA filter housing or to water separation tank in positions corresponding to current system operating configuration.

4. Turn on heaters and blower.

5. Make input to computer to initiate operation of system.

6. Adjust valves on wellhead manifold(s), HEPA trailer manifold, and blower bypass to establish desired flow rate and vacuum pressure.

7. Walk through system to observe proper functioning of components.

D.2.2 Normal Operation

The normal operation of the VES is controlled by the process control system and does not require fulltime support by an individual. It is not critical that the system operate constantly or that the system is brought back to an operating condition immediately following a shutdown. A daily walk-through of the system is performed by a technician during normal working days.

The purpose of this daily walkthrough is to note the proper functioning of the components and the process in general. If the system is shut down when the technician visits the site, the technician troubleshoots and brings the system back to an operating condition.

D.2.2.1 Daily Checklist. A daily walkthrough of the system is performed by a technician during normal working days. The technician will complete a daily checklist (Figure D-1). The completed daily checklists are to be kept in the project files.

D.2.2.2 GAC Changeout Procedure. The GAC canisters are stored at the site in three separate locations. These locations allow the proper handling, usage, and storage of the canisters and are as follows:

- Area 1 - This storage area is for GAC canisters that have been received, but have not been used since receipt.
- Area 2 - This area is the process treatment area where the GAC canisters are in actual use. The first position for a GAC canister in this area is the secondary position in the treatment train where it functions as a polishing step. The second position in this area is the primary position in the treatment train where it functions as the principal treatment step.
- Area 3 - This storage area is for GAC canister that have been used and are awaiting shipment from the site.

The GAC canisters require changeout for any reason, including:

- Primary GAC canister has reached its sorptive capacity of carbon tetrachloride.
- Breakthrough of carbon tetrachloride in a concentration exceeding the established limit is noted by instrumentation between primary and secondary GAC canisters or downstream of secondary GAC canister.
- Radon level in primary GAC canister has exceeded established limit.
- Primary or secondary GAC canister has a physical defect that has become apparent.

On receipt, each of the GAC canisters shall be labeledwith a serial number. The use of a GAC canister shall be made in the site logbook and shall include the assigned serial number.

Procedures for changeout of GAC canisters are detailed as follows:

1. System must be shut down before changeout of the GAC canisters may be performed. Typically, the system will be shut down by the process control system for one of the reasons noted above and a message corresponding to that reason will be provided on system computer. If system is not shut down and a GAC canister changeout is to be performed, shut down system by input to system computer.

2. Make a note on GAC canister near inlet hose with a permanent marker on primary and secondary GAC canisters of action being undertaken. This information should include the time and date of action and initials of person performing action. Input this information to the site logbook.

3. Close valves on inlet and outlet to primary and secondary GAC canisters. Disconnect fittings attached to GAC canisters. Attach caps to fittings.

4. Use forklift to move GAC canisters. Move primary GAC canister to Area 3. Then move secondary GAC canister into primary position. Then move an unused GAC canister from Area 1 into secondary canister position.

5. Remove caps from fittings of new primary and secondary GAC canisters. Reconnect fittings to these GAC canisters (i.e., inlet to inlet and outlet to outlet). Open valves on GAC canisters.

6. Restart system according to startup procedure.

D.2.2.3 Response to System Shutdown. The process control system will shut down the system due to any of several reasons. The automatic shutdown responses are described in Section D.1. Typically, a technician will arrive at the site and note that the system is shut down. The technician will then access the cause of shutdown via the system computer, correct the problem, and restart the system.

D.2.3 Short Term Shutdown

A short term system shutdown occurs as a result of an alarm condition in the process control system. The process control system shuts off the blower and the well field heaters. No shutdown operations need to be performed by the technician for a short term shutdown.

D.2.4 Long Term Shutdown

A long term system shutdown occurs when the system will not be operated for more than 3 days. The following details the procedures to be performed by the technician for long term shutdown.

1. Shut down system by input to system computer.

2. De-energize electrical equipment of system by placing main system disconnect in "OFF" position.

3. Drain water separation tank on blower trailer and dispose of water appropriately.

4. Place all valves in system in fully closed position.

5. Document reason for long term shutdown in project files.

D.3 SYSTEM MAINTENANCE

The following instruments are calibrated annually:

Flow meters
FTM1, FTM2, FTM3, FTM4, FTM5, FTM6, FTM7

Temperature
TTHH1, TTHH2, TTHH3, TTHH4, TTHH5, TTHH6, TTHH7, TTHH8, TT1, TT2, TT3, TT4, TT5, TTA

Vacuum gages
PTW1, PTW2, PTW3, PTW4, PTW5, PTW6, PTW7, PTW8, PTW9, PTW10, PTW11, PTW12, PTM1, PTM2, PTM3, PTM4, PTM5, PTM6

Relative humidity
GTRH

Barometric pressure
PTA

Pressure gage
PT7

Alpha CAM
RT1

Beta CAM
RT2

Carbon tetrachloride detectors
CT1, CT2, CT3

Radon gas concentration detector
RTG1, RTG2, RTG3

Table D-1. Component Maintenance Frequency.

Component	Frequency	Procedure
Belt	Quarterly	Check
Blower Motor	Quarterly	Check
Blower	Quarterly	Check
Ground Fault Interrupters	Annually	Test

VAPOR EXTRACTION SYSTEM TEST UNIT DAILY CHECKLIST

Name :__________
Date :__________
Time :__________
Weather Conditions :__________

Place one copy of this completed checklist in files at site and one copy in project files.

Check and note any of the following conditions:

	NO	YES	CORRECTIVE ACTION TAKEN / COMMENTS
Electrical generator <25ft from GACs	__	__	
Generator fuel source <50ft from GACs	__	__	
Loose connections	__	__	
Leaks	__	__	
Indicating gauges out of range	__	__	
Excessive blower noise/vibration	__	__	
Computer in alarm mode	__	__	
CAM in alarm mode	__	__	
Radon meter reading >4236pCi/l	__	__	

Were the GAC canisters changed out? NO__ YES__
If YES, What is the ID Number of the canister removed :________
What is the ID Number of the canister placed in the primary treatment position :________
What is the ID Number of the canister placed in the secondary treatment position :________

*Record stack carbon tetrachloride concentrtation (CT3) : ____
*Record stack radon concentration (RTC3) : ____
*Download data from hard drive daily and initial when completed : ____
*Flush data from hard drive weekly and initial when completed : ____
*Perform weekly operability check of instruments and initial when completed: ____
*Perform monthly system functional test and initial when completed : ____

Check the following items and correct as required.

	Good	Corrective Action Taken/Comments
* Site Access	__	
* Site Housekeeping	__	

Comments:

Reviewer:__________

Figure D-1. Daily Checklist.

APPENDIX E

HEALTH AND SAFETY PLAN

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E.1 GENERAL CONSIDERATIONS AND REQUIREMENTS

The purpose of this health and safety plan is to outline standard health and safety procedures for Westinghouse Hanford Company (Westinghouse Hanford) employees and contractors engaged in operation and maintenance of the carbon tetrachloride expedited response action (ERA) vapor extraction system (VES). This HSP pertains to the operation of the VES within the 216-Z-1A Tile Field. Activities include startup, operation, routine maintenance, and shut-down procedures. Appropriate site-specific safety documents (e.g., Hazardous Waste Operations Permit [HWOP] or Job Safety Analysis [JSA]) will be written for each specific activity or group of activities. A more complete discussion of Westinghouse Hanford environmental safety procedures is presented in the Westinghouse Hanford manual *Health and Safety for Hazardous Waste Field Operations* (WHC 1992, Vol. 4).

All employees of Westinghouse Hanford or any contractor who is involved with onsite activities of the VES shall read the site-specific safety documents and related HWOP as well as attend a prejob safety or tailgate meeting to review and discuss the activity.

E.1.1 Designated Safety Personnel

The project engineer and each environmental field service technician (EFST) are responsible for site safety and health. Specific individuals will be assigned on an activity-by-activity basis by project management. Their names will be properly recorded before the activity is initiated. The HWOP shall identify personnel responsible for each specific task.

All nonroutine activities shall be cleared through the project engineer. The project engineer has responsibility for the following:

- Allocating and administering resources to successfully comply with all technical and health and safety requirements.
- Verifying that all permits, supporting documentation, and clearances are in place (e.g., electrical outage requests, welding permits, excavation permits, HWOP or JSA, sampling plan, radiation work permits [RWP], and onsite/offsite radiation shipping records).
- Providing technical advice during routine operations and emergencies.
- Coordinating conflict resolutions that may arise between RWP and the implementation of the HWOP or JSA with health physics.
- Handling emergency response situations as required.
- Conducting prejob safety meetings.
- Interacting with adjacent building occupants and/or inquisitive public.

The EFST is responsible for implementing the HWOP at the site. The EFST shall perform the following:

- Daily walkthrough inspection using the Daily Checklist. The EFST will check the VES equipment and operation when the system is operating.
- Monitor chemical, physical, and (in conjunction with the health physics technician) radiation hazards to assess the degree of hazard present during maintenance activities.
- Inform the appropriate site management and safety personnel of significant changes to the system.
- Determine that levels of protection and safety equipment available, as outlined in the HWOP, are available and are properly utilized.
- Monitor the performance of all personnel to ensure that the required safety procedures are followed as outlined in the HWOP.
- Halt operations immediately, if necessary, due to unsafe or potential exposure problems.

The ultimate responsibility and authority for employee's health and safety lies with the employee and the employee's colleagues. Each employee is responsible for exercising the utmost care and good judgment in protecting his or her personal health and safety and that of fellow employees. Should any employee observe a potentially unsafe condition or situation, it is that employees responsibility to immediately bring the observed condition to the attention of the appropriate health and safety personnel, as designated previously. In the event of an immediately dangerous or life-threatening situation, the employee automatically has temporary "stop work" authority and the responsibility to immediately notify the field team leader or site safety officer.

When work is temporarily halted because of a safety or health concern, personnel will exit the exclusion zone and meet at a predetermined place in the support zone. The field team leader, site safety officer, and health physics technician will determine the next course of action.

E.1.2 Medical Surveillance

All field team members engaged in activities within the 216-Z-1A Tile Field shall have baseline physical examinations and be participants in Westinghouse Hanford (or an equivalent) hazardous waste worker medical surveillance program. For further information refer to the Westinghouse Hanford manual *Health and Safety for Hazardous Waste Field Operations* (WHC 1992, Vol. 4).

Medical examinations will be designed to identify any pre-existing conditions that may place an employee at high risk, and will verify that each worker is physically able to perform the work required by this plan without undue risk to personal health. The physician shall determine the existence of conditions that may reduce the effectiveness or prevent the employee's use of respiratory protection. The physician shall also determine the presence of conditions that may pose undue risk to the employee while performing the physical tasks of this work plan using level B personal protection equipment. This would include any condition that increases the employee's susceptibility to heat stress.

E.1.3 Training

Before engaging in any onsite activities, each team member is required to have received 40 hours of health and safety training related to hazardous waste site operations and at least 8 hours of refresher training each year thereafter, as specified in 29 CFR 1910.120. In addition, each inexperienced employee (never having performed site characterization) will be directly supervised by a trained/experienced person for a minimum of 24 hours of field experience.

Site-specific training shall be given to each person entering the 216-Z-1A Tile Field after that individual has read the HWOP under which they are entering to perform work. Visitors shall be briefed by the project engineer or the EFST prior to their entering the field. Both the site-specific training and the briefings shall cover: levels of protection, chemical and radiological hazards present, safety procedures, decontamination, emergency procedures, and offer the individuals the opportunity to ask questions.

For the purposes of this plan, a visitor is defined as any person visiting the Hanford Site who is not a Westinghouse Hanford employee or a Westinghouse Hanford contractor directly involved in the Resource Conservation and Recovery Act of 1976/Comprehensive Environmental Response, Compensation and Liability Act of 1980 facility investigation activities, including but not limited to those engaged in surveillance, inspection, or observation activities.

Visitors who must, for whatever reason, enter the restricted or radiation control areas, shall be subject to all of the applicable training, respirator fit testing, and medical surveillance requirements addressed in Westinghouse Hanford environmental investigations instructions (EII) 1.1 and Appendix B to EII 1.1 (WHC 1988a).

E.1.4 Radiation Dosimetry

All personnel engaged in onsite activities shall be assigned dosimeters according to the requirements of the RWP applicable to that activity. All visitors shall be assigned basic dosimeters. Work within the radiation control areas require all personnel to review and follow the RWP.

E.1.5 Requirements for Use of Respiratory Protection

All employees of Westinghouse Hanford and subcontractors who may be required to use air-purifying or air-supplied respirators must be included in the medical surveillance program and be approved for the use of respiratory protection by the Hanford Environmental Health Foundation or other licensed physician. Each team member must be trained in the selection, limitations, and proper use and maintenance of respiratory protection (existing respiratory protection training may be applicable towards the 40-hour training requirement).

Before using an air-purifying respirator, each employee must have been fit-tested (within the previous year) for the specific make, model, and size according to Westinghouse Hanford fit-testing procedures. Beards (including a few days' growth), large sideburns, or moustaches that may interfere with a proper respirator seal are not permitted.

Subcontractors must provide evidence to Westinghouse Hanford that personnel are participants in a medical surveillance and respiratory protection program that complies with 29 CFR 1910.120 and 29 CFR 1910.134, respectively.

E.2 GENERAL PROCEDURES

The following personal hygiene and work practice guidelines are intended to prevent injuries and adverse health effects. A hazardous waste site poses a multitude of health and safety concerns because of the variety and number of hazardous substances present. These guidelines represent the minimum standard procedures for reducing potential risks associated with this project and are to be followed by all jobsite employees <u>at all times</u>.

E.2.1 General Work Safety Practices

The following work practices shall be observed when operating within the 216-Z-1A Tile Field:

- Eating, drinking, smoking, taking certain medications, chewing gum, and similar actions are prohibited within the exclusion zone. All sanitation facilities shall be located outside the exclusion zone; decontamination is required per the site-specific HWOP or JSA.

- Personnel shall avoid direct contact with contaminated materials unless necessary for sample collecting or required observation.

- While operating in the controlled zone, personnel shall use the "buddy system" during certain tasks.

- Requirements of Westinghouse Hanford radiation protection and RWP manuals shall be followed for all work involving radioactive materials or conducted within a radiation control area.

- Normal onsite work activities shall only be carried out during daylight hours, unless the entire control zone is adequately illuminated with artificial lighting. Illumination of the work area shall meet the requirements of 29 CFR 1910.120(m).

- Be alert to potentially changing exposure conditions as evidenced by such indications as perceptible odors.

- Do not under any circumstances enter or ride in or on any backhoe bucket, materials hoist, or any other similar device not specifically designed for carrying passengers.

- Tools and equipment will be kept off the ground whenever possible to avoid tripping hazards and the spread of contamination.

- Catalytic converters on the underside of vehicles are sufficiently hot to ignite dry grass. Team members should not drive over dry grass that is higher than the ground clearance of the vehicle and should be aware of the potential fire hazard posed by catalytic converters at all times. Never allow a running or hot vehicle to sit in a stationary location over dry grass or other combustible materials.

- Follow all provisions of each site-specific RWP.

E.2.2 Personal Protective Equipment

- Personal protective equipment will be selected specifically for the hazards identified in the HWOP. The EFST in conjunction with Westinghouse Hanford Health Physics and Industrial Hygiene and Safety is responsible for choosing the appropriate type and level of protection required for different activities at the job site.

- Levels of protection shall be appropriate to the hazard to avoid either excessive exposure or additional hazards imposed by excessive levels of protection. The HWOP will contain provisions for adjusting the level of protection as necessary. These personal protective equipment specifications must be followed at all times, as directed by the field team leader, health physics technician, and EFST.

- Each employee must have a hardhat, safety glasses, and substantial protective footwear available to wear as specified in the HWOP, JSA, or RWP.

- In areas where excessive noise is present signs will be posted "Hearing Protection Required" and team members will have had noise control training.

- Personnel should maintain a high level of awareness of the limitations in mobility, dexterity, and visual impairment inherent in the use of level B and level C personal protective equipment.

- Personnel should be alert to the symptoms of fatigue, heat stress, and cold stress and their effects on the normal caution and judgment of personnel.

E.2.3 Personnel Decontamination

- The HWOP will describe in detail methods of personnel decontamination, including the use of contamination control corridors and step-off pads when appropriate. The location and arrangement of the decontamination equipment shall be incorporated in the HWOP.

- Thoroughly wash hands and face before eating or putting anything in the mouth to avoid hand-to-mouth contamination.

- Disposable clothing will be containerized as determined by the site safety officer.

E.2.4 Emergency Preparation

- Prearranged hand signals or other means of emergency communication will be established when respiratory protection equipment is to be worn, because this equipment seriously impairs speech.

- The Hanford Fire Department shall be notified before the start of the project. This notification shall include the location and nature of the various types of field work activities as described in the work plan. A site location map shall be included in this notification.

E.3 SITE BACKGROUND

On December 20, 1990, the U.S. Environmental Protection Agency and the Washington Department of Ecology issued a letter to the U.S. Department of Energy, Richland Field Office requesting an ERA plan to mitigate further carbon tetrachloride soil and groundwater contamination in the 200 West Area. Westinghouse Hanford drafted an ERA project plan proposing a goal to reduce or stabilize the carbon tetrachloride vapor spread from the unsaturated (vadose) soils. These soils are beneath the Plutonium Finishing Plant (PFP) disposal sites.

The disposal site investigated at this time is the 216-Z-1A Tile Field. This site received PFP plutonium treatment process carbon tetrachloride waste mixtures from 1955 until 1973 at different time intervals. Predications for the amount of carbon tetrachloride disposed at each of the sites range from 100,000 to 400,000 liters (averaging approximately 200,000 liters) each.

The VES is used to pull the soil vapor from the subsurface via wells and then treat the soil vapor to remove the carbon tetrachloride. The treatment system adsorbs the carbon tetrachloride in granular-activated carbon (GAC) canisters.

E.4 SCOPE OF WORK AND POTENTIAL HAZARDS

The VES comprises two trailers and the GAC canisters. The first trailer contains the intake manifold, HEPA filters, vapor-liquid separator, and electrical controls. The second trailer contains the blower and exhaust stack and the piping leading to the GAC canisters located next to the blower trailer.

Activities that will be performed include: startup procedures will be prepared, routine maintenance (emptying water tank, replacement of instruments for calibration, source checking of continuous air monitors, and the changeout of HEPA filters), and sample collection.

E.4.1 Chemical Hazards

The primary chemical of concern at the 216-Z-1A Tile Field is carbon tetrachloride. The disposal sites also contain other deposited organics such as tributyl phosphate, dibutylphosphate, and their degradation products (<30% by volume).

Carbon tetrachloride and its decomposition products (methylene chloride and chloroform) are volatile compounds that exhibit acute effects through inhalation. The American Conference of Governmental Industrial Hygienists lists each of these compounds as suspected carcinogens (ACGIH 1991).

E.4.2 Radiation Hazards

Although plutonium and americium are present in the soils underlying the tile field, the characterization unit pulled no particulate radiation from the subsurface, as evidenced by analysis of the system components following the tests. Naturally occurring radon gas and its daughter products were detected in the extracted soil vapor. Radon and its daughter products are expected to be the primary radiation hazard of concern.

E.4.3 Assessment and Mitigation of Potential Hazards

The likelihood of significant exposure (100 mR/h or greater) to external radiation is remote and can be readily monitored and controlled by limiting exposure time, increasing distance, and employing shielding as required. Appropriate respiratory protection, protective clothing, and decontamination procedures will be implemented as necessary to reduce potential inhalation, ingestion, and dermal exposure to acceptable levels.

Assessments of inhalation hazards from chemical exposures will be made as part of the HWOP. Dermal exposure to toxic chemical substances is not expected to pose a significant problem for the identified tasks given the use of the designated protective clothing. The appropriate level of personal protective clothing and respiratory protection will vary from work task to work task.

E.5 ENVIRONMENTAL AND PERSONAL MONITORING

The site safety officer or authorized delegate shall be present as necessary and shall be in charge of all environmental/personal monitoring equipment. Industrial Hygiene and Safety shall review all activities involving or potentially involving radiological exposure or contamination control and shall prescribe the appropriate level of technical support and/or monitoring requirements.

Monitoring of airborne radioactive contamination levels and external radiation levels will be conducted by the on-site health physics technician, when necessary. Action levels will be consistent with derived air concentrations and applicable guidelines as specified in the Westinghouse Hanford radiation protection manual (WHC 1988b).

Appropriate respiratory protection shall be required when conditions are such that the airborne contamination levels may exceed an 8-hour derived air concentration (e.g., the presence of high levels of uncontrolled, loose contamination on exposed surfaces or operations that may raise excessive levels of dust contaminated with airborne radioactive materials, such as excavation or drilling under extremely dry conditions).

Specific conditions requiring the use of respiratory protection because of radioactive materials in air will be incorporated into the RWP. If, in the judgement of the health physics technician, any of these conditions arise, work shall cease until appropriate respiratory protection is provided.

E.6 PERSONAL PROTECTIVE EQUIPMENT

The level of personal protective equipment required initially at a site will be specified in the task specific HWOP. Personal protective clothing and respiratory protection shall be selected to limit exposure to anticipated chemical and radiological hazards. Work practices and engineering controls may be used to control exposure.

E.7 SITE CONTROL

The VES is located in a restricted area which is roped off. Only authorized personnel are allowed to enter this area after meeting the requirements for training and medical surveillance. The GAC canisters that are being used and those that have been used are placed in a radiation control area, within the restricted area.

Control zone boundaries may be increased or decreased based on results of field monitoring, environmental changes, or work technique changes. The site RWP and the contractor's standard operating procedures for radiation protection may also dictate the boundary size and shape. All team members must be surveyed for radioactive contamination when leaving the controlled zone if in a radiation zone.

No disturbances of the soils in the 216-Z-1A Tile Field may be performed. Operations that may impact the soils must first be cleared through Criticality Analysis.

E.8 DECONTAMINATION PROCEDURES

During site activities, potential sources of contamination may include airborne vapors, gases, dust, mists, and aerosols; splashes and spills; walking through contaminated areas; and handling contaminated equipment. Personnel who enter the exclusion zone may be required to go through the decontamination as determined by the site safety officer.

E.9 CONTINGENCY AND EMERGENCY RESPONSE PLANS

As a general rule, in the event of an unanticipated, potentially hazardous situation indicated by instrument readings, visible contamination, unusual or excessive odors, or other indications, team members shall temporarily cease operations and move upwind to a predesignated safe area as specified in the task-specific HWOP.

E.10 REFERENCES

ACGIH, 1991, *Threshold Limit Values and Biological Exposure Indices for 1990-1991*, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio.

WHC, 1988a, *Environmental Investigations and Site Characterization Manual*, WHC-CM-7-7, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988b, *Radiation Protection*, WHC-CM-4-10, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992, *Health and Safety for Hazardous Waste Field Operations*, WHC-CM-4-3 Vol. 4, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX F

DATA MANAGEMENT PLAN

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F.1 INTRODUCTION

This data management plan (DMP) addresses management of data generated from the 200 West Area Carbon Tetrachloride Expedited Response Action (ERA) project activities.

A considerable amount of data will be generated through the implementation of the ERA monitoring. The quality assurance project plan (QAPP) provides the specific procedural direction and control for obtaining and analyzing samples in conformance with requirements to ensure quality data results. Chapter 4 of the document provides the detailed logistical methods to be employed in selecting the location, depth, frequency of collection, etc., of media to be sampled and the methods to be employed to obtain samples of the selected media for cataloging and analysis.

A records management plan for all Westinghouse Hanford Environmental Restoration Remedial Action (ERRA) Program records is described in Michael (1991). The plan enables the program office to identify, control, and maintain the quality assurance, decisional, or regulatory prescribed records generated and used in support of the ERRA Program.

The *Environmental Information Management Plan* (Michael et al. 1990) provides an overview of the management of environmental information generated by Hanford Site programs (p. DMP-3).

The Project Lead is responsible for maintaining and transmitting data to the designated storage facility.

F.2 TYPES OF DATA

F.2.1 Monitoring

General data types generated by monitoring tasks include field logbooks, screening data, verified sample analyses, historic data, quality assurance/ quality control data, reports, memoranda/meeting minutes, telephone conversations, raw sample data, videotapes, magnetic media and supporting documentation, and chart recordings. Collection and handling of these data are governed by Environmental Investigation Instruction (EII) 1.6, Records Management (WHC 1988), and those task-related procedures listed in the QAPP. The data will be stored in project files or in the Environmental Data Management Center (EDMC). Appropriate sample data will also be stored in the Hanford Environmental Information System.

The EDMC is the Westinghouse Hanford Environmental Division's central facility that provides a file management system for processing environmental information. All data entering the EDMC are indexed, recorded, and placed into safe and secure storage. The EDMC manages and controls the administrative record and the Administrative Record Public Access Room. The administrative record provides an index and key information on all data transmitted to the EDMC. Data designated for placement into the administrative record will be copied, placed into the Hanford Site Administrative Record File, and distributed by the EDMC to the user community.

Data transmittal to the EDMC is governed by the following procedures:

- EII 1.6, Records Management (WHC 1988)
- TPA-MP-02, Information Transmittals and Receipt Controls (DOE-RL 1990)
- TPA-MP-07, Administrative Record Collection and Record Management (DOE-RL 1990).

Part I of the *Environmental Information Management Plan* (Michael et al. 1990) describes the central file system and services provided by the EDMC.

Information Resource Management is the designated records custodian (permanent storage) for Westinghouse Hanford.

The PNL operates the Hanford Meteorological Station that collects and maintains meteorological data. This database contains meteorological data dating from 1943 to present. Data management is discussed in the Hanford Meteorological Data Collection System and Data Base (Andrews 1988).

F.2.2 Administrative

Related administrative data include personnel training records, exposure records, respiratory protection fitting records, personnel health and safety records, and compliance and regulatory data.

The Hanford Environmental Health Foundation (HEHF) performs the analyses on the nonradiological health and exposure data and forwards summary reports to the Industrial Safety and Fire Protection Group and the Environmental Health and Pesticide Services Section (EHPSS) within the Westinghouse Hanford Environmental Division. Nonradiological and health exposure data are maintained also for other site contractors who may be involved in ERA activities. The HEHF provides summary data to the appropriate site contractor. HEHF also maintains personal health and safety records. The preparation of health and safety plans and the resulting data records are addressed in EII 2.1, Preparation of Hazardous Waste Operations Permits (WHC 1988) and occupational health monitoring is covered in EII 2.2, Occupational Health Monitoring (WHC 1988).

The Westinghouse Hanford EHPSS maintains personal protection equipment fitting records and maintains nonradiological health field exposure and exposure summary reports provided by HEHF for Westinghouse Hanford Environmental Division and subcontractor personnel.

Training records for Westinghouse Hanford and subcontractor personnel are managed by the Westinghouse Hanford Technical Training Support Section. Other Hanford Site contractors (PNL and Kaiser Engineers Hanford [KEH]) maintain their own personnel training records.

The PNL collects and maintains data on occupational radiation exposure. This database contains respiratory personnel protection equipment fitting records, work restrictions, and radiation exposure information. Data management is discussed in the Hanford Meteorological Data Collection System and Data Base (Andrews 1988).

Compliance and regulatory data is maintained by the EDMC. Procedures governing data transmittal are listed in the Site Evaluation Data section of the DMP.

F.3 DATA QUANTITY

Data quantities will vary depending on frequency of collction as described in Chapter 4, Monitoring.

F.3.1 Environmental Information Management Plan

The *Environmental Information Management Plan* (Michael et al. 1990) introduces Westinghouse Hanford records management and engineering document control systems and their relationship to environmental programs. Part I of this plan describes the overall Westinghouse Hanford systems that are generally applied to documents and records. Specific information is provided about the operation of the EDMC, a central facility that receives, processes, and maintains information related to environmental program activities. Part II of the plan addresses computer-based information, with an emphasis on scientific and technical data.

F.3.2 Hanford Environmental Information System

The HEIS is being developed by PNL for Westinghouse Hanford as a primary resource for computerized storage, retrieval, and analysis of quality-assured technical data associated with Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Resource Conservation and Recovery Act of 1976 (RCRA) activities being undertaken at the Hanford Site. The HEIS will provide a means of interactive access to data sets. Implementation of HEIS will serve to facilitate data consistency, quality, traceability, and security within a single controlled database. Portions of the HEIS are currently operational.

The following is a list of data types proposed to be entered into HEIS:

- Geologic
- Geophysical
- Atmospheric
- Biotic
- Site Characterization
- Soil Gas
- Waste Site Information
- Surface Monitoring
- Groundwater.

Existing databases that are proposed to be incorporated, in whole or in part, within HEIS include the Waste Information Data System (WHC 1991), and the Hanford Groundwater Database.

F.4 REFERENCES

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WHC, 1991, *WIDS Database Field Descriptions and Data*, WHC-MR-0056, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

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Date(s) of Conference or Meeting: NA | City/State: NA | Will proceedings be published? ☐ Yes ☐ No | Will material be handed out? NA ☐ Yes ☐ No

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